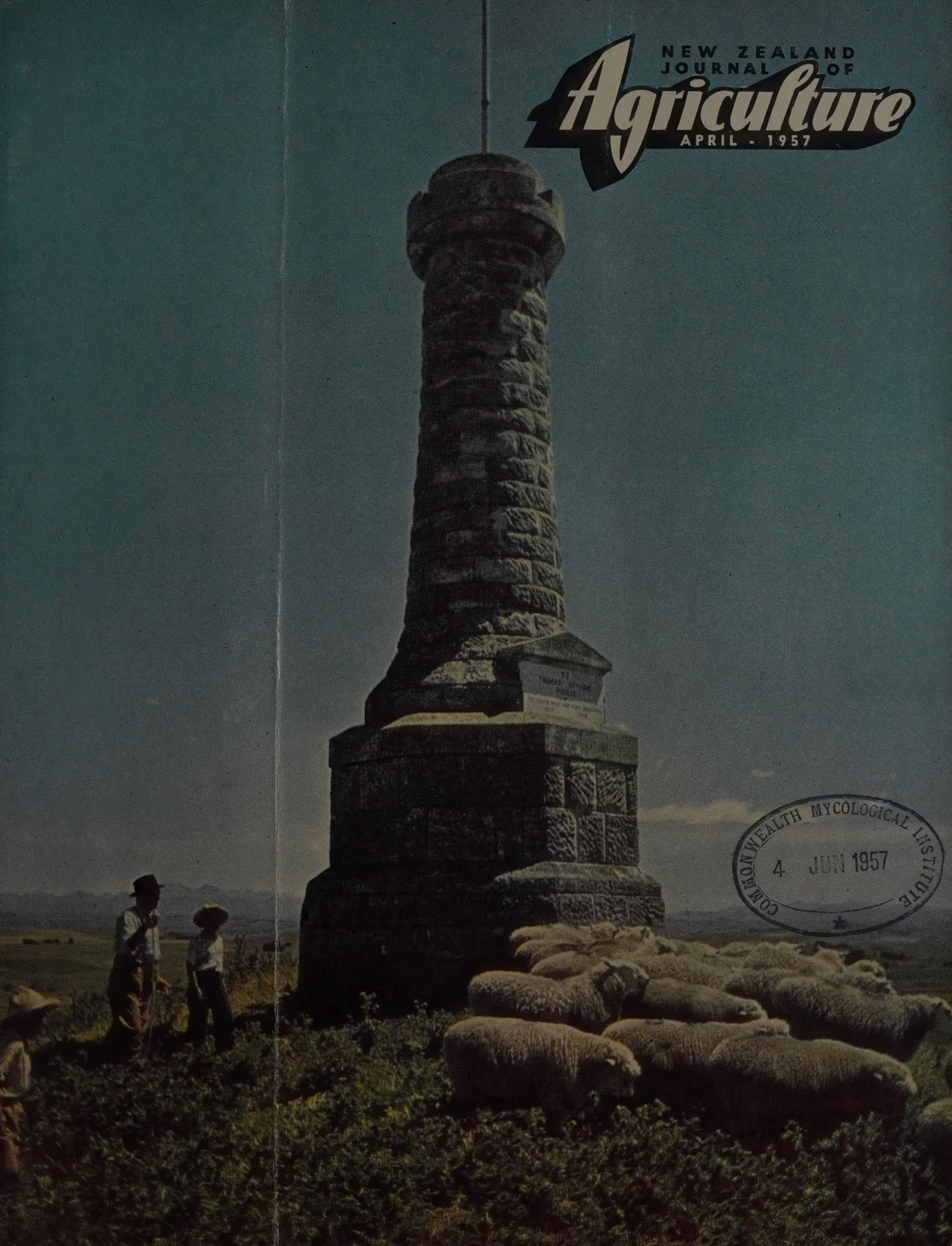

COMMONWEALTH MYCOLOGICAL INSTITUTE
4 JUN 1957

Cooper News

FARM BULLETIN published by COOPER, McDOUGALL & ROBERTSON (N.Z.) LTD.
World famous Manufacturers of Sheep Dips, Worm Drenches and other Stock Remedies.

No. 53 PUBLISHED EVERY SECOND MONTH APRIL, 1957

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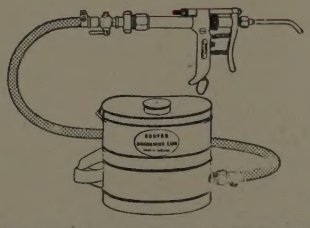

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1957
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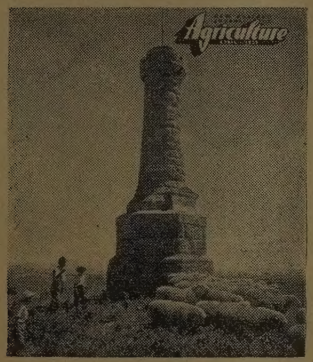
This Month's Cover



Sheep that comprised most of the first shipment of frozen meat from New Zealand 75 years ago were slaughtered on the New Zealand and Australian Land Company's Totara Estate near Oamaru. The memorial reproduced on this month's cover has from its eminence on the Totara Estate dominated the North Otago landscape for 50 years. It honours Thomas Brydone, New Zealand superintendent of the company, who, with William Soltau Davidson, general manager of the company in Edinburgh, was responsible for this bold experiment that established the New Zealand meat export trade. At celebrations of the 75th anniversary of the industry in February of this year memorial gates to the Totara Estate were unveiled and a special meeting of the New Zealand Meat Producers Board was held in the Brydone homestead. Colour photograph by L. F. Johnstone.

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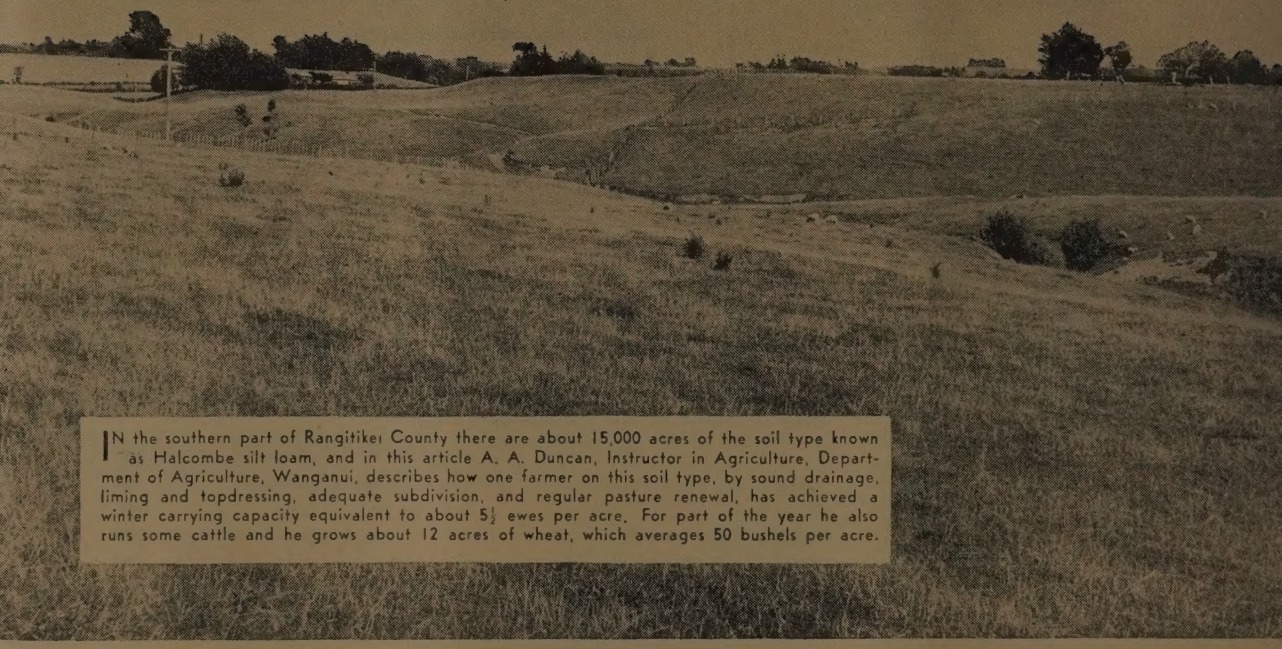
High Production on Rangitikei Fat Lamb Farm



IN the southern part of Rangitikei County there are about 15,000 acres of the soil type known as Halcombe silt loam, and in this article A. A. Duncan, Instructor in Agriculture, Department of Agriculture, Wanganui, describes how one farmer on this soil type, by sound drainage, liming and topdressing, adequate subdivision, and regular pasture renewal, has achieved a winter carrying capacity equivalent to about 5½ ewes per acre. For part of the year he also runs some cattle and he grows about 12 acres of wheat, which averages 50 bushels per acre.

RANGITIKEI COUNTY is an important sheep farming county and in 1956 had 1,054,400 breeding ewes, which is the second highest of any county in the North Island. The county is extensive, having an occupied area of 845,519 acres and stretching from the west coast between the Rangitikei and Wangaehu River mouths to beyond Waiouru. Though cropping and dairying are well represented in the county, sheep farming accounts for the major part of the acreage. The type of sheep farming varies from intensive fat lamb farming in the Marton area, through the breeding and fat lamb country of Taihape, to the extensively farmed Waiouru tussock lands. Southern Rangitikei is an important source of fat lambs and it is the management of a fat lamb farm in this area that is described in this article.

Details of Farm

The farm, owned by Mr. A. Brightwell, is situated close to the Bulls-Wanganui highway and is 3 miles from Bulls. Of the farm's 173 acres, 115 acres are flat, 51 acres are ploughable hillside, and 7 acres are unploughable hillside and gully.

The farm winters 726 ewes, 250 ewe hoggets, 20 killers, and 18 rams. There are 12 main paddocks of approximately 13 acres each, 2 house paddocks (one of 6 acres and the other of 2 acres), and a ram paddock of 2 acres. The ewe flock consists of approximately 160 2-tooths, 150 4-tooths, 145 6-tooths, 138 4-year-olds, and 135 5-year-olds.

Climate and Soil

The average annual rainfall is 36in. and is fairly well distributed except in January, February, and March in some years, when dry weather can become a problem. The average number of frosts per annum is 21, with the heaviest usually not greater than 7 degrees. In occasional years there may be a frost of up to 12 degrees.

The country is rolling and has a soil of the type known as Halcombe silt loam (13b). There is an average of 8in. of black topsoil over a heavy clay subsoil. Some ironstone mottling through the clay subsoil is accentuated at seepage points and it is not uncommon to find ironstone pans there. In its natural state the country lies wet, because the clay subsoil stops water getting away.

Flock Management

The flock is maintained by buying in Romney ewe lambs at the February or March sales. (The buying in of lambs is not a common practice in the district; many farmers buy 2-tooths and older ewes.) The lambs are wintered on swedes and chou moellier and culled in August for size and thrift. They are shorn in October and again in February as 2-tooths. The second shearing has resulted in a better lambing percentage (on an average there are not more than 5 per cent. of dry ewes among the 2-tooths) and facilitates mothering, because at lambing the ewes' wool is shorter and newly born lambs can get a drink more easily.

Before the rams are put out on 1 March the ewes, with the exception of the 2-tooths, are ring crutched and foot-rotted. At present there are 16 Southdown and 2 Suffolk rams and they are put out at the ratio of 1 : 40.

▲ Part of the Romney ewe flock.

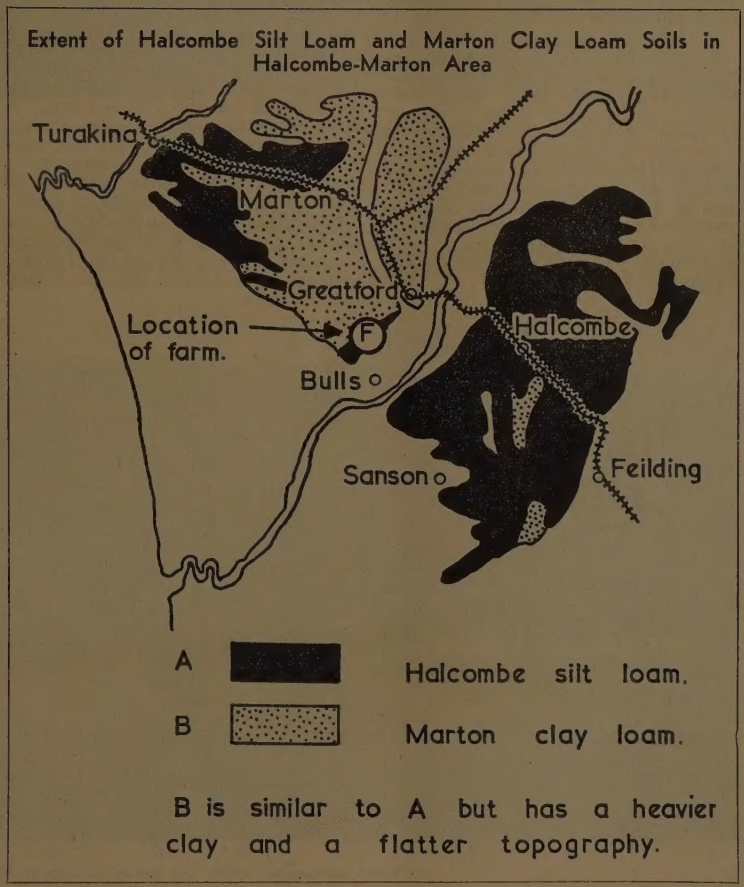
It is intended to increase the Suffolk rams to a third of the total to get heavier early lambs for the Christmas premium. The Suffolks will be put out 10 days earlier (20 February) with the 4-tooth and older ewes. Suffolks are not put with the 2-tooths, because there is too much lambing difficulty. The rams are taken out on 1 June.

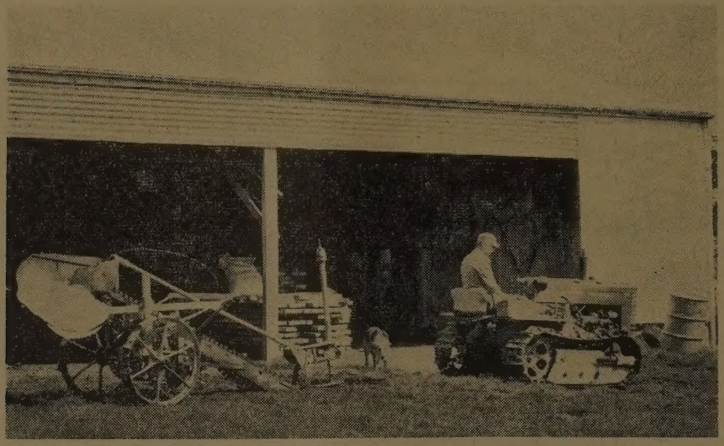
Lambing

The flock is run in three mobs until lambing, one of the mobs being 2-tooths and the other two of older ewes. The mobs are rotated round the farm and have an average of 4 days in each paddock. As there are 12 main paddocks, each can be spelled for 12 to 14 days. The ewes are crutched at the end of June in preparation for lambing, which starts at the end of July.

Just before lambing 150 of the late lambers are drafted off and this permits more time to be spent with the early lambers. At the same time the 2-tooths are mixed with the main flock, because the older sheep have a steadying influence on them. When they are by themselves they are too easily frightened and if one starts to run, it is likely that the whole mob will follow. The flock is then split up into 6 or 7 mobs and put into a corresponding number of paddocks.

The ewes are split into 6 or 7 mobs rather than kept in one large mob because in late winter and spring the ground is heavy and wet and when the sheep are in one large mob they trample a tremendous amount of feed into the ground. This trampling is accentuated at lambing because regular shepherding is required and each





The modified ditcher used to dig tile drains and the tracklaying tractor which pulls it.

time a man enters the paddock the sheep congregate.

As lambing progresses the ewes with lambs at foot are shifted into separate paddocks which have been spelled and contain fresh feed. This process goes on until there is a concentration of 5 to 7 ewes and lambs to the acre in any particular paddock. If there is a lot of feed, they are put on at 7 to the acre and then eased back to 5 later. The aim is to have approximately 5 ewes and lambs to the acre and they are kept in the same paddocks until the first lambs are drafted.

Docking starts in early September, when the first lambs are 6 weeks old, and at the same time the dry ewes are taken out and sold to the butcher. The lambing percentage taken at docking varies between 100 and 105 per cent. of ewes put to the ram. A draft of early lambs for the Christmas premium is taken in the last week in October, when approximately a sixth of the total number of lambs is taken at an average weight of 32lb.

The ewes from which lambs are drafted are kept in a separate mob and used for cleaning up the rougher pasture and generally are done hard. This allows the ewes with lambs to be given the best food.

The ewes are shorn in mid-November, and 3 weeks later, when the lambs have recovered from any bruising that may have occurred, a second draft of a further third of the total number of lambs is taken at an average weight of 36lb. The ewes from which these lambs are drafted are also separated and done hard.

A third draft of lambs is taken in early January, when a further third of the total number of lambs is drafted at an average weight of 33lb. The remaining lambs are weaned, shorn, and put on to spelled paddocks. A fourth draft of lambs is taken in mid-February and the tail enders, usually about 100, are drafted some time before the end of April.

The sound-mouthed 6-year-old ewes are sold at the autumn ewe fair, usually to the Waikato; those with broken mouths are fattened and sold to the butchers. The over-all death-rate in ewes is 4 per cent. and most of this is due to lambing troubles.

Cattle

About 30 run yearlings or 2-year-old cattle are bought each spring and sold in autumn. Old cattle are not favoured, because they are big and heavy and plough up the gullies too much when they are running round. The cattle are bought for the sole purpose of controlling the feed for the weaned lambs.

Dairy cattle have been tried, but have been discarded because they are too inclined to pick out the good bits of pasture and discard the roughage.

Crop of swedes, which are grown for winter feed.

Dam, constructed with a bulldozer, which supplies three troughs by gravitation.

The cattle are concentrated in the paddocks that are going to be used for the weaned lambs about 2 to 3 weeks before weaning.

Drainage

Good drainage is fundamental to pasture improvement on this clay country, both on the flats and gully sides. The system of drainage used is moles 5ft. apart crossed with tile drains at 50yd. intervals.

The tile drains are dug with a ditcher modified by mounting it on a pair of wheels to eliminate the back-breaking work of keeping the digger vertical. The digger is pulled by a 20 h.p. tracklaying tractor, takes an average cut of 6in. in depth, and digs the drain to the required depth of 2ft. 6in. in five runs.

After the tiles are laid the trench is filled completely with topsoil. First, all the displaced topsoil is returned, then the topsoil on the sides is spaded in, and finally a furrow from each side of the drain is ploughed in. The clay is spread well away from the drain.

The moles are pulled across the tile lines, usually in October, and the junctions are speared. For mole drains to function effectively the slope of the paddock must be uniform, and to achieve this, levelling is done during cultivations between the wheat crop and sowing to new grass.

Cropping

Cropping is carried out for two purposes: To alleviate the winter feed shortage and, equally important, to renew pastures. On an average 12 acres of swedes and/or chou moellier are grown each year and the pasture in any particular paddock is renewed every 12 years. Usually Superlative swedes are sown at 1lb. per acre in mid-December with ½lb. of chou moellier and 3cwt. of serpentine superphosphate. The swede varieties Crimson King and Grandmaster have been tried, but have been discarded in favour of Superlative, which gives a heavier crop and keeps equally well. The variety Calder is being tried this year because of its resistance to aphids.

Aphid infection on Superlative swedes is serious in a dry year, because it attacks the plants when they have already been stunted by dry conditions, and very often the swedes do not recover. In occasional years chou moellier is used as a pure stand and is sown at 4lb. per acre. The heavy seeding results in a dense crop and the sheep clean up all the stalks. Chou moellier is a reliable winter feed crop, because in a dry season it is not critically affected by aphids and in a wet season it can withstand damp soil conditions. The swede or chou moellier crop is break fed with hoggets from 1 June. In August the late-lambing ewes are used to clean up the stalks and bulbs.

When the swedes are finished the ground is ploughed, disced twice, harrowed, and sown to Tainui wheat. It is sown at the end of September at 3 bushels to the acre with 3cwt. of superphosphate. The wheat is harvested in February and gives an average yield of 50 bushels to the acre. The header harvester is set close to the ground and this gives a maximum length of straw for pressing.

After the straw is baled the paddock is ploughed, disced twice, levelled, and rolled in preparation for sowing down to new grass. The seeds mixture is 30lb. of perennial ryegrass, 6lb. of cocksfoot, and 3lb. of white clover. It is broadcast and sowing is followed by a light chain harrowing. Until this year 10lb. of short-rotation ryegrass was included with a lighter sowing of cocksfoot, but short-rotation ryegrass has been found to die out under sheep grazing in dry summers. An endeavour is made to graze the new grass at least twice before the onset of winter to make it stool out.

Haymaking

Normally only a small acreage is cut for hay to meet the requirements

of the house cows and hoggets. The hoggets when they are on swedes are given constant access to good hay, which is kept in two portable racks. In some years when there is a heavy spring surplus of growth up to 30 acres may be cut for hay and this is baled and sold. There is normally a strong white clover aftermath after the hay crop and this is particularly good for fattening the weaned lambs.

Another method of using surplus spring growth is to close up paddocks for harvesting ryegrass and white clover seed. This is quite successful sometimes, but in many seasons there is too much rain in January and February for good harvesting conditions.

Topdressing

When new pasture is sown 2cwt. of superphosphate per acre is used and a further 2cwt. is applied the following spring. After this, 2½cwt. to 3cwt. of superphosphate per acre is applied annually, except for the year before ploughing, when the paddock does not receive any. About once every 7 or 8 years the superphosphate is replaced by basic slag at the same rates. The general liming programme is 1 ton every 4 to 5 years, the lime being applied in summer and autumn, when the ground is firm.

Recent soil tests have shown some of the paddocks to be low in potash and these paddocks will be topdressed with potassic superphosphate instead of straight superphosphate. (Responses to potash have been obtained on similar clay soils in the district with a similar history of regular topdressing with lime and phosphate.) Potassic superphosphate will be used at 3cwt. per acre annually.

Water Supply

The country has no natural supply of water, but the impervious subsoil lends itself to the successful construction of dams. These are constructed with a bulldozer near the heads of gullies to permit water to be fed by gravitation to troughs in the paddocks. Two or perhaps three paddocks are served from one dam. The dams provide water even in the driest summers.

Essentials for High Production

The management of this southern Rangitikei fat lamb farm illustrates the important points in high production per acre on Halcombe silt loam. They are:—

1. Good drainage: No pasture improvement is possible without a good system of underground drainage. A combination of moles and tiles is a very satisfactory way of achieving this.

2. Adequate lime and phosphate: The soil is naturally low in lime and phosphate and these deficiencies have to be made good before first-class pastures can be obtained. When the lime and phosphate levels are built up the use of potash becomes worth while.

3. Regular pasture renewal: Ploughing up and resowing is the best way of renewing run-out pastures. Even under good management pastures deteriorate, because low-producing grasses creep into the sward and gradually assume dominance. Much of Rangitikei County is suitable for cereal growing and a crop can be taken after a winter feed crop to fit in with autumn sowing of pasture.

4. Adequate subdivision: There are 12 main paddocks on the farm and three subsidiary ones, and all of these paddocks are necessary to carry out the principles of mob stocking and spelling, which are of great importance in good husbandry.

Fruit Crop Estimates for 1956-57 Season

THE following estimates made in March of the fruit crop for the 1956-57 season are in 000's of bushel cases. They are summarised from information supplied by field officers of the Horticulture Division of the Department of Agriculture. Districts producing less than 500 bushels of a variety are not shown, but are included in totals. District totals of more than 500 are rounded to the nearest 1000.

FRUIT	DISTRICT								
	Auckland Province except Gisborne	Gisborne	Hawke's Bay	Wellington and Taranaki Provinces	Nelson Province	Marlborough	Canterbury and North Otago	Central Otago	Total
APPLES—									
Ballarat	68	5	90	3	9	8	9	1	190
Cox's Orange Pippin	7	1	72	2	71	11	11	12	185
Delicious	26	5	100	4	210	30	17	61	453
Dougherty	12	4	70	0	32	2	1	0	121
Granny Smith	103	4	130	5	102	3	3	5	355
Gravenstein	15	0	30	0	81	2	1	2	131
Jonathan	10	0	45	1	270	28	15	20	388
Sturmer	10	8	220	13	401	35	56	38	781
Others	91	4	176	8	232	18	57	42	628
Total	340	30	932	35	1,407	136	170	182	3,232
PEARS—									
Beurre Bosc	1	1	3	0	11	0	0	0	16
Louise Bonne de Jersey	1	0	19	0	0	0	0	1	21
Packham's Triumph	10	0	10	0	7	0	0	0	28
P. Barry	3	1	16	1	6	0	2	0	28
W. B. Chretien	10	1	80	0	55	1	4	13	163
Winter Cole	1	1	65	3	47	1	7	7	132
Winter Nelis	1	1	35	0	8	1	2	12	59
Others	13	0	8	1	16	1	9	6	53
Total	39	4	236	5	150	4	24	40	500
OTHER FRUITS—									
Peaches	82	12	330	2	54	8	10	108	606
Apricots	0	1	6	0	0	0	22	151	180
Nectarines	2	1	13	0	2	1	2	27	48
Plums	41	3	75	1	11	2	13	36	182
Cherries	0	0	1	0	1	2	1	9	14
Quinces	7	0	5	0	3	0	1	1	17

COMMONWEALTH ECONOMIC COMMITTEE

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Market Intelligence Services, providing regular comprehensive and prompt information on the supply and distribution throughout the world of certain commodities of particular importance in Commonwealth trade, are issued as follows:—

Wool Intelligence (monthly).

Intelligence Bulletin (Dairy Produce and Meat) (Monthly with supplement "Weekly Dairy Produce Supplies").

Fruit Intelligence (monthly with supplement "Weekly Fruit Supplies").

Grain Bulletin (monthly, including the former "Rice Bulletin").

Tobacco Intelligence (quarterly, supplemented by the "Tobacco Bulletin" appearing in intervening months).

The subscription rates, including postage, are:—

Wool Intelligence. £2 per annum.

Tobacco Intelligence. £1 per annum.

Fruit Intelligence and the Intelligence Bulletin. £3 per annum each (including the weekly supplements), or £2 per annum each (without the supplements).

Grain Bulletin. £2 per annum including the Rice Supplement which can also be obtained separately for £1 per annum.

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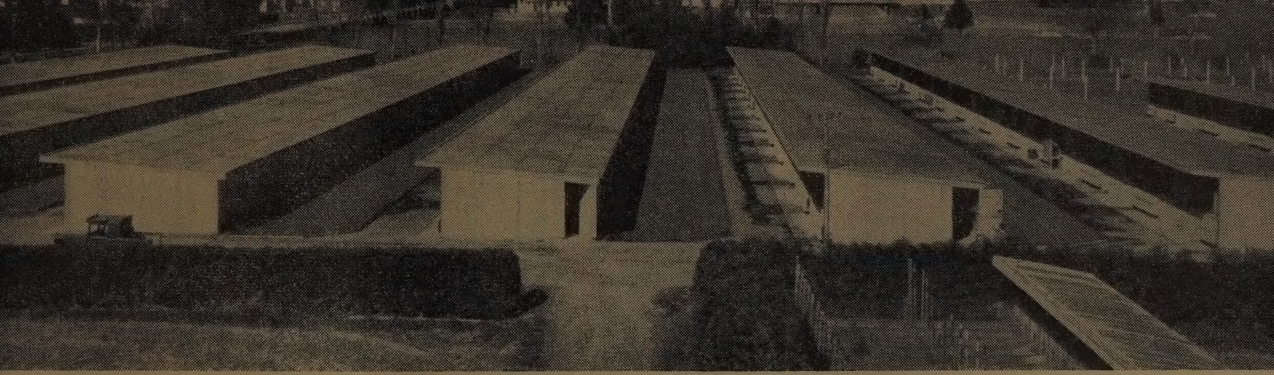


Eighth Laying Trial of Prospective Poultry Breeding Stock

THE eighth breeders' laying trial held at the Department of Agriculture's Poultry Demonstration Plant, Upper Hutt, started on 20 February 1956 and ended 48 weeks later on 20 January 1957. Twenty-eight pens, each of 20 pullets, were entered in Section A, and eight pens of 10 pullets each in Section B. The 38 pens contained a total of 640 pullets, 40 pullets fewer than for the previous year. Once again the trial was successful, and a detailed report on it is given here by F. C. Bobby,* Superintendent, Poultry Industry, Department of Agriculture, Wellington, and J. Edmondson, Poultry Experimentalist, Department of Agriculture, Upper Hutt.

THE various breeds represented in the 1956-57 trial were as follows:—

Breed	No. of pullets
Australorps ..	390 (Section A, 18 pens) (Section B, 3 pens)
White Leghorns ..	120 (Section A, 6 pens)
Rhode Island Reds	90 (Section A, 4 pens) (Section B, 4 pens)
Black Orpingtons ..	30 (Section B, 3 pens)
Barred Rocks ..	10 (Section B, 1 pen)

The condition of the birds on arrival was satisfactory. It was obvious, however, that the pen of Barred Rocks was immature and unlikely to come into production at the beginning of the trial.

Management

The management which had proved satisfactory for the seventh laying trial was repeated in 1956-57, including the use of artificial lighting during late autumn and winter and the feeding of dry mash. The latter was available to the birds throughout the day and was supplemented by two grain feeds, one in the early morning and one in the late afternoon. The dry mash was based on the following formula:—

	lb.
Bran	22
Pollard	20
Wheat meal	24
Ground oats	7
Maize meal	10
Meat meal (58 per cent. protein) ..	15
Common salt	1
Ground limestone or oyster-shell dust	1
	100

A vitamin additive was included in the mash, ensuring an adequate supply of vitamins A and D. The birds also received greenfeed and had access at all times to shell and metal grits.

The grain ration included wheat, barley, oats, and kibbled maize, the proportions varying to some extent according to the availability of the grains. This feeding maintained the condition of the birds satisfactorily during the trial, with a few exceptions where pullets did not appear to have the constitution to stand up to heavy egg production.

Egg Production

Egg production was similar to that obtained in the previous trial. Details of the flock-housed averages for the various breeds, with those of the 1955-56 trial in brackets, are as follows:—

	No. of birds	Flock-housed average No. of eggs
Australorps	390	196.9 (196.4)
White Leghorns ..	120	190.5 (191.0)
Rhode Island Reds ..	90	209.4 (199.6)
Black Orpingtons ..	30	177.0 (197.5)
Barred Rocks	10	209.2 (226.6)

The figures for Australorps and White Leghorns are almost identical with those for the previous year, and an improvement of 10 eggs per pullet is recorded for the Rhode Island Reds. The quality of the Black Orpingtons was not as good as in 1955-56.

As this is the last trial which will be conducted at Upper Hutt, a comparison of egg production for heavy breeds and light breeds over the 8 years during which trials have been conducted is of interest.

	Flock-housed average egg production	
	Heavy breeds	Light breeds
1949-50	149.6	152.6
1950-51	175.0	151.3
1951-52	178.2	167.7
1952-53	174.2	158.2
1953-54	177.0	145.7
1954-55	175.0	142.8
1955-56	197.9	191.0
1956-57	198.2	190.5

These figures reveal two interesting points. The first and most spectacular one is the marked increase in egg production of both heavy breeds and light breeds when artificial lighting and dry-mash feeding were introduced in the 1955-56 trial. This should be sufficient proof to convince commercial egg producers of the value of artificial lighting. The second point is the marked superiority of heavy breeds over light breeds where lighting is not used. This superiority was reduced considerably during the last two trials, but for a true economic comparison it is necessary to study the graphs which show when the eggs were laid. If this factor is combined with the varying prices of eggs over the year, the true value of the production of heavy breeds and light breeds is obtained.

Two graphs show the percentage egg production of heavy breeds and light breeds over the 12 4-weekly periods. Included are the comparable figures for the 1955-56 trial. The graphs show that the heavy-breed birds give a better winter egg production than do the light breeds, but that the latter maintain their production better during summer, that is, the last five periods of the trial. This is shown more clearly in the graph giving production for heavy and light breeds.

Mention has already been made of the impressive reaction in egg production to artificial lighting. The bottom graph on page 329 shows this to great effect in the winter egg production.

HEADING PHOTOGRAPH: A section of the Department's Poultry Demonstration Plant at Upper Hutt. The two long houses in the centre have been used for the past 8 years for the breeders' laying trial. A part of this housing will be used for experiment and demonstration in future.

* The concluding section of this author's article about the handling and marketing of shell eggs, which was to have been published this month, will appear in next month's issue of the "Journal".

48 WEEKS' PRODUCTION OF EACH PULLET AND WEIGHT (In pounds) OF EACH BIRD AT END OF TRIAL

Breeder and pen number																					Total for pen (including floor eggs)	Flock-housed average per pen
SECTION A: 20 PULLETS																						
White Leghorns																						
Jenkins, A. J. ..	260	214	196	230	197	215	204	191	188	229	235	246	202	256	201‖	147	172	155	.	.	3,831	191.5
(1)	4.4	4.6	4.6	4.2	4.5	5.0	4.5	4.5	5.2	5.7	3.9	4.4	4.5	5.0	5.1‖	4.7	4.8	4.1				
Jorey, G. E. ..	190	240	225	256	191	210	210	230	204	218	220	203‖	173	148	143	.	.	.	.	.	3,657	182.8
(2)	5.2	4.9	6.2	6.3	5.3	5.8	5.6	4.9	5.4	5.0	4.5	5.3‖	5.0	4.0	5.2							
Brassknocker Poultry Farm (3)	242	224	213	250	243	223	240	243	211	210	231	197‖	169	144	133	173	133	.	.	.	3,822	191.1
	4.8	5.6	5.3	5.0	5.0	5.8	5.6	5.0	5.1	6.2	5.0	5.3‖	5.6	6.9	6.0	6.0	6.5	5.5				
Bedford, L. G. ..	242	205	219	198	206	211	247	243	206	221	203	250	186	252	235	223	183	185	243	239	4,415	220.7
(4)	4.4	4.5	4.7	4.1	4.5	4.2	4.1	4.2	4.5	4.2	4.6	5.1	5.0	3.8	4.0	4.6	4.6	4.4	4.8	4.4		
C. Walker and Sons (5)	214	200	191	192	207	200	200	206	209	187	210	180	185	196‖	171	158	155	151	161	.	3,618	180.9
	4.8	5.1	5.0	4.4	5.3	4.4	4.6	4.9	4.6	4.5	4.8	5.6	4.9	4.9‖	4.9	4.8	4.8	5.5	2.7			
Ching, V. P. ..	209	188	202	183	204	225	205	215	249‖	152*	148	178	153	131	134	165	179	.	.	.	3,511	175.5
(6)	6.0	5.9	5.6	5.5	6.3	4.5	6.0	5.2	4.4‖	4.6	6.0	5.2	5.8	4.6	5.7	5.1	5.7					
Australorps																						
Rasmusen, M. A.	254	180	213	232	236	205	246	216	230	267	199	202	249‖	146	166	91	143	.	.	.	4,066	203.3
(7)	6.0	6.6	5.6	6.2	5.4	5.9	5.9	5.9	6.5	5.8	6.4	7.5	7.1‖	6.9	6.5	5.0	5.7					
Rasmusen, M. A.	239	184	255	198	229	204	257	212	221	201	255	215	245	268‖	172	159	91	.	.	.	4,228	211.4
(20)	5.5	7.3	6.0	6.0	6.8	6.0	6.7	5.2	6.9	5.4	6.3	6.0	5.8	5.8‖	6.6	5.7	5.5					
Siddall and Son	181	254	190	211	185	247	183	256	249	206	246‖	159	167	156	177	160	174	2	.	.	3,500	175.0
(8)	6.2	6.9	7.3	7.0	6.7	7.0	6.1	6.1	6.5	6.3	6.0‖	8.0	7.0	6.6	6.7	7.1	6.6	7.1				
Dovey, L. E. ..	191	221	223	226	240	199	188	202	227	224	202	208	203	190	247	225‖	124	140	.	.	3,925	196.2
(9)	7.3	7.0	6.0	6.7	7.0	6.4	7.4	9.0	6.6	5.6	8.3	6.9	5.6	6.9	4.7	6.3‖	6.9	7.2				
King, A. E. ..	217	264	255	245	237	254	209	198	241	228	236	244	197	252‖	199*	163	169	119	161	.	4,180	209.0
(10)	6.0	7.6	6.6	7.2	5.7	6.2	6.2	6.2	6.4	5.9	8.2	6.9	6.2	5.6‖	6.2	6.0	4.9	5.0	5.5			
Poultry Demonstration plant (11)	234	266	193	199	255	191	245	200	236	215	237	263	272	260	242‖	172	172	160	172	.	4,323	216.1
	6.2	6.9	8.4	6.8	6.2	4.7	5.7	8.0	4.4	6.6	5.8	6.3	6.0	6.7	6.7‖	6.1	6.5	8.9	6.3			
C. Walker and Sons (12)	246	250	243	247	282	230	226	263	209	259	244	205	209	278‖	22	164	.	.	.	.	4,349	217.4
	6.0	6.2	6.3	6.0	5.7	7.7	5.8	5.9	6.5	5.8	5.4	6.0	5.8	5.3‖	6.4	6.1						
Jorey, G. E. ..	243	260	183	235	187	229	222	228	241	208	182	234	201‖	152	98	175	.	.	.	.	3,821	191.5
(13)	7.0	6.3	6.7	6.2	6.9	5.5	6.1	8.4	7.2	6.6	6.9	7.0	5.6‖	7.8	5.3	5.8						
Ching, V. P. ..	246	219	227	222	264	255	264	244	229	190	231	254	245‖	174	145	127	161	.	.	.	3,974	198.7
(14)	6.9	7.0	6.7	5.7	6.0	6.0	5.3	6.1	6.6	5.8	6.1	5.7	7.4‖	6.6	7.0	6.4	6.0					
Phare, J. R. ..	240	215	267	255	246	227	191	225	261	183	224	232	227‖	145	178	162	178	.	.	.	3,856	192.8
(15)	7.2	6.6	6.6	8.0	6.3	6.1	6.9	5.9	6.1	6.6	5.9	6.4	6.5‖	5.7	7.3	7.3	6.5					
Jenkins, J. A. ..	254	180	213	206	237	182	246	266	186	214	224	208	287‖	165	175	128	171	119	98	164	3,943	197.1
(16)	4.7	7.2	6.2	4.0	6.5	6.0	5.4	6.7	6.3	5.2	6.0	6.6	5.6‖	6.9	7.3	6.2	6.0	6.3	7.0	7.2		
Coman, F. J. ..	289	208	215	251	219	213	242	192	241	264	232	220	216	182	229	166‖	120	172	.	.	4,116	205.8
(17)	6.6	7.3	7.0	6.7	7.0	6.6	7.7	7.5	7.2	7.7	8.1	5.8	5.9	6.2	5.8	6.4‖	8.0	7.6				
Bagley and Sons (18)	180	202	193	192	200	198	253	242	263	230	209	254‖	133	115	133	57	145	174	.	.	3,502	175.1
	6.4	7.0	8.4	6.7	5.0	6.5	6.6	6.8	6.4	7.3	7.4	6.0‖	6.2	6.4	9.0	7.4	6.9	7.6				
Smith, A. J. ..	260	217	247	218	241	241	269	213	248	197	202	225	186	245	239‖	177	145	154	.	.	4,119	205.9
(21)	6.6	8.4	7.4	5.7	6.5	7.1	5.7	7.4	6.7	6.2	7.7	7.6	8.1	6.1	6.4‖	4.3	6.8	7.0				
Burd, A. E. ..	209	242	258	223	235	202	208	223	258	209	261‖	165	147	173	.	.	.	.	.	.	3,389	169.4
(23)	7.0	6.4	5.8	6.2	5.7	6.7	6.4	6.0	4.7	4.6	6.3‖	6.8	7.4	7.9								
Black, G. W. ..	233	245	215	263	197	213	200	255	253	223	202	267	224	224‖	58	58	.	.	.	.	3,530	176.5
(24)	5.7	7.5	6.4	6.2	6.3	6.8	6.1	6.1	7.1	6.0	6.8	6.8	5.6	6.0‖	6.7	6.4						
Pen No. 19 ..	197	236	274	250	253	188	269	208	220	263	201	240	274	250	261‖	159	148	114	145	.	4,285	214.2
	4.5	7.0	5.9	6.1	7.0	7.7	6.7	6.7	4.6	7.2	6.0	4.2	6.0	5.8	6.4‖	7.3	8.2	5.5	6.0			
Pen No. 22 ..	229	220	209	238	212	212	229	268	198	265	237	182	259	246	181	209‖	167	112	90	.	4,108	205.4
	6.4	7.0	4.4	6.1	7.0	6.2	6.7	7.0	6.4	6.1	3.9	5.6	5.7	6.3	6.1	3.9‖	3.2	4.8	5.7			
Rhode Island Reds																						
Higgins, N. R. ..	196	218	295	260	245	265	209	221	189	203	243	215	242	231	261‖	103	143	139	.	.	4,291	214.5
(25)	3.9	6.0	6.3	4.6	5.6	6.3	5.2	6.2	6.4	5.9	6.1	5.2	6.6	5.8	6.0‖	6.8	5.7	7.1				
Bagley and Sons (26)	244	260	255	237	224	221	236	245	201	287	205	229	182	192	281‖	154	104	177	145*	4,320	216.0	
	6.0	5.5	6.5	8.3	7.3	5.8	7.2	5.4	6.3	5.1	6.3	5.8	6.5	5.1	5.8	6.4‖	6.9	4.7	6.2	6.1		
Craig, L. W. ..	219	206	225	218	263	231	224	202	202	250	213	251	237	203‖	168	95	84	.	.	.	3,972	198.6
(27)	6.5	8.3	6.4	7.1	6.0	7.4	6.0	5.1	6.0	6.6	5.9	5.6	6.2	5.3‖	8.1	6.4	5.4					
Vincent, R. H. ..	182	244	237	250	199	263	231	250	259	253	223	212	239‖	164	166	110	178	89	164	.	4,149	207.4
(28)	5.0	6.4	6.7	6.8	6.0	6.3	7.1	6.8	7.9	6.6	6.0	7.0	6.3‖	7.5	7.5	6.9	5.4	5.2	5.7			
SECTION B: 10 PULLETS																						
Australorps																						
Goodman, C. M.	250	261	185	228	199	235‖	176	133	.	.	.	.	.	.	.	.	.	.	.	.	1,773	177.3
(29)	6.0	5.1	6.1	5.5	5.8	5.3‖	5.4	6.1														
Drummond, Mrs. C. A. (30)	245	207	193	211	202	257	211	184	193‖	171	.	.	.	.	.	.	.	.	.	.	2,084	208.4
	5.6	5.8	6.4	6.4	6.1	4.4	5.7	5.8	5.6‖	7.4												
McKie, A. N. ..	207	213	232*	215	249	228‖	82	63	128	.	.	.	.	.	.	.	.	.	.	.	1,724	172.4
(31)	6.0	5.9	5.7	5.5	5.7	5.8‖	4.2	5.9	5.6													
Black Orpingtons																						
Morris, J. H. ..	239	198	242	237‖	157	2	142	112*	138	105	.	.	.	.	.	.	.	.	.	.	1,577	157.7
(33)	5.2	5.6	5.2	5.1‖	5.7		7.6	5.8	6.8	5.8												
Bremner, M. and E. (34)	195	218	198	225	195	213‖	24	171	.	.	.	.	.	.	.	.	.	.	.	.	1,609	160.9
	7.5	6.3	6.2	4.5	6.2	7.7‖	4.3	7.6														
Dudding, E. C. ..	243	253	285	187	261	187	238	231‖	123	141	.	.	.	.	.	.	.	.	.	.	2,150	215.0
(35)	6.2	5.5	6.5	7.4	6.1	6.6	6.5	6.8‖	6.1	6.4												
Rhode Island Reds																						
Barron, D. R. ..	219	231	180	235	241	209	209	197	261‖	128	.	.	.	.	.	.	.	.	.	.	2,113	211.3
(32)	6.9	6.6	6.8	6.1	6.4	6.1	6.1	7.6	5.7‖	6.6												
Barred Rocks																						
Polson, H. ..	203	211	218	237	234	186	226	243‖	79	.	.	.	.	.	.	.	.	.	.	.	2,092	209.2
(37)	5.7	5.3	6.6	5.2	4.9	5.7	5.1	4.9‖	4.6													

Only birds alive at the end of the trial are recorded. Pullets which laid a preponderance of underweight eggs (less than 2oz.) have an asterisk against the total of eggs.

Individual Pen Results

A pen of White Leghorns gave the highest egg production in Section A. This is the third time in the 8 years that a pen of White Leghorns has headed the trial for egg production. In Section B (10 pullets) a pen of Black Orpingtons headed the list. The following were the leading pens:—

SECTION A (20 pullets)

Breeder	Breed	Flock-housed average per bird
L. G. Bedford	White Leghorns ..	220.7
C. Walker and Sons	Australorps ..	217.4
Poultry Demonstration Plant	Australorps ..	216.1
Bagley and Sons	Rhode Island Reds	216.0
N. R. Higgins	Rhode Island Reds	214.5

SECTION B (10 pullets)

E. C. Dudding	Black Orpingtons	215.0
D. R. Barron ..	Rhode Island Reds	211.3
H. Polson ..	Barred Rocks ..	209.2

In the large table on page 328 full details are set out of the results achieved by all pens, including the individual performance of each pullet returned to the breeder at the end of the trial. A minimum of 180 eggs in 48 weeks has been set as an arbitrary standard for egg production for birds to be used as breeding stock. Birds which qualify must have the other desirable characteristics for breeding stock. In the large table the production of the birds which have come up to this standard is shown in heavy type. The number of birds which qualified in the various breeds is as follows:—

Breed	Total birds in trial	No. up to standard	Percentage
White Leghorns ..	120	81	67
Australorps	420	269	64
Rhode Island Reds ..	80	58	72
Black Orpingtons ..	60	18	30
Barred Rocks ..	10	8	80

The flock-housed average egg productions of the leading pens in Section A in each year of the trials are as follows:—

		Eggs
1949-50	White Leghorns ..	186.1
1950-51	Australorps ..	193.9
1951-52	White Leghorns ..	206.1
1952-53	Australorps ..	206.8
1953-54	Australorps ..	207.3
1954-55	Australorps ..	212.3
1955-56	Rhode Island Reds	228.3
1956-57	White Leghorns ..	220.8

The highest flock-housed average obtained during the 8 years was in 1955-56 from a pen of Barred Rocks in Section B (10 pullets) which averaged 239.0 eggs per pullet.

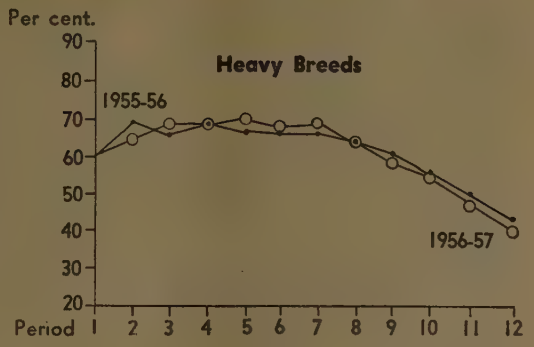
Food Consumption and Cost

The total food—mash and grain—consumed by all pens irrespective of breed was again recorded. Reduced to a basis of per bird consumption for 48 weeks, the figures were:—

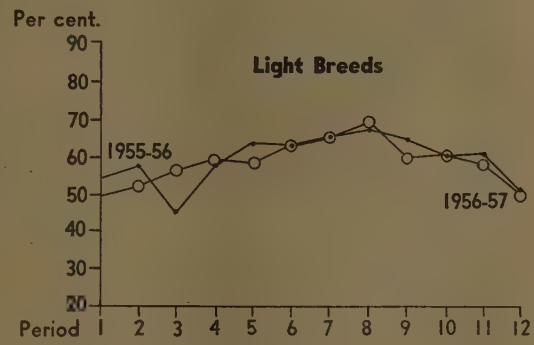
	1955-56 lb.	1956-57 lb.
Mash	54.2	54.2
Grain	47.5	55.4
	101.7	109.6

Percentage Production Based on Bird Days

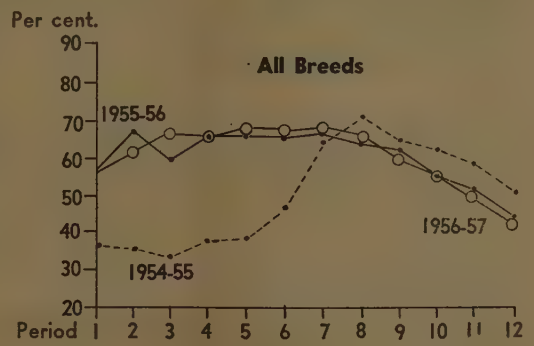
Period	1955-56 Per cent.	1956-57 Per cent.
1 ..	58	58
2 ..	70	64
3 ..	66	68
4 ..	69	69
5 ..	67	70
6 ..	67	68
7 ..	67	69
8 ..	65	65
9 ..	61	59
10 ..	56	55
11 ..	52	48
12 ..	44	41
Av. ..	62	61



Period	1955-56 Per cent.	1956-57 Per cent.
1 ..	55	50
2 ..	58	52
3 ..	45	56
4 ..	58	59
5 ..	63	58
6 ..	63	63
7 ..	65	65
8 ..	66	68
9 ..	64	61
10 ..	62	62
11 ..	61	58
12 ..	52	51
Av. ..	59	59



Period	1954-55 Per cent.	1955-56 Per cent.	1956-57 Per cent.
1 ..	37	58	57
2 ..	36	68	62
3 ..	34	61	66
4 ..	38	66	67
5 ..	39	66	68
6 ..	48	66	67
7 ..	60	67	68
8 ..	73	65	66
9 ..	67	62	60
10 ..	65	57	57
11 ..	60	53	50
12 ..	52	45	43
Av. ..	51	61	61



Two years' figures only are quoted, because dry mash was fed ad lib. in these 2 years. In the years before 1955-56 the birds received wet mash, which can very easily be a restrictive form of feeding mash. Furthermore, artificial lighting was used during the last 2 years. It is considered that the figure this year has been partly influenced by sparrows, which unfortunately found an easy method of access to the pens and made good use of their opportunities.

With mash at £27 12s. 6d. per ton and grain at £27 6s. per ton the cost of feed per pullet was 30s. 4d. for the 48 weeks.

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Get all the cricket's wickets

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If you want to keep the Cricket off your grass — clean bowl him (or her) before the grubs start eating. Aldrex 2 is your ideal ammunition. It's a special preparation of aldrin that makes ground control of crickets, locusts, etc. much more economical and effective than was ever possible before. That's already been proved by the test of practical experience in different parts of New Zealand. With aldrin you get the knock-out certainty of the latest hydro-carbon super insecticides along with right-through-the-season staying power in the ground — *at very low cost.*

Just 1-1½ pints per acre of Aldrex 2 stops the crickets
Aldrex 2 can also be used to advantage as a spray—is the ideal and most economical medium for many spray operations on garden and market garden crops.

Further information from your Shell depot, office or stockist
Aldrex 2 is a special Shell preparation of the wonder insecticide aldrin, which is made available all over the world by SHELL.

A1.7

The gradual increase in cost of feeding over the years is shown below.

	Food consumed per bird lb.	Cost s. d.
1950-51	92.2	18 2
1951-52	94.1	23 2
1952-53	89.1	23 10
1953-54	89.0	24 2
1954-55	83.4	22 10
1955-56	101.7	27 11
1956-57	109.6	30 4

For the eighth trial the food-egg conversion rate was 6.3lb. of food per dozen eggs produced, giving a food cost-egg ratio of 20.9d. per dozen eggs.

Mortality

Losses among the heavy-breed pullets were similar to those of the 1955-56 trial, but a 3 per cent. increase is recorded for White Leghorns. Figures for the eight trials show that losses among heavy birds have been reasonable and consistent, except for 1951-52. Losses among White Leghorns have been higher and more variable year by year than those of the heavy breeds.

MORTALITY (per cent.)

	Heavy breeds	Light breeds
1949-50	12.5	18.1
1950-51	10.8	16.2
1951-52	19.4	14.4
1952-53	12.9	17.1
1953-54	15.4	22.8
1954-55	10.2	19.0
1955-56	10.9	8.6
1956-57	10.2	11.7

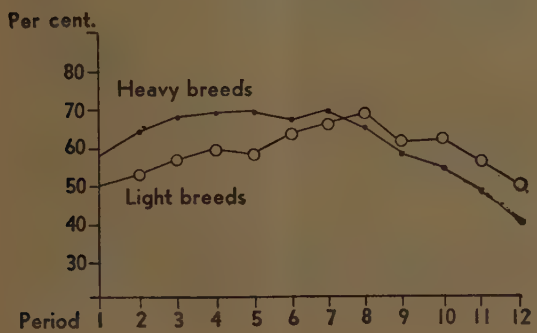
The heaviest losses over the 8 years have been caused by leucosis, but for the eighth trial deaths from leucosis have fallen compared with those in the previous year, 14 cases being reported out of the total mortality of 67 birds. In 1955-56 comparable figures were 20 out of 71 deaths. There was, however, an increase in losses due to breakdowns in the reproductory system such as egg peritonitis and prolapsis. These accounted for 26 deaths out of the total of 67.

The interior of one of the pens of the breeders' laying trial, showing the type of dry-mash hopper used. A service passage runs the full length of the house and is at the back of the perches in the illustration. A shade is fitted to the electric light to allow full use of the 40-watt globe.

Closing the Trial

After careful consideration the Department of Agriculture has decided to discontinue this laying trial. Two factors have influenced this decision. The more important reason is the much increased risk involved today in bringing birds on to the Demonstration Plant from areas where fowl pox has prevailed from time to time. If this disease was introduced by birds in the trial, not only would trial results be adversely affected but owners might well be concerned about birds being returned to their farms. Furthermore, an outbreak in the trial could easily spread to other stock at the plant, and consequently a year's work could be spoilt both in the experimental pens and the two breeding projects. The risk has now become too great. The other reason is that the Plant is now in the centre of a housing area and will be moved. Though it is not yet known when this move will take place, it could be earlier than is expected and this would cause a serious problem if a laying trial was being held.

Percentage Production (Based on Bird Days) of Heavy Breeds and Light Breeds in 1956-57 Trial



Period	Heavy breeds Per cent.	Light breeds Per cent.
1 ..	58	50
2 ..	64	52
3 ..	68	56
4 ..	69	59
5 ..	70	58
6 ..	68	63
7 ..	69	65
8 ..	65	68
9 ..	59	61
10 ..	55	62
11 ..	48	58
12 ..	41	51
Av. ..	61	59

Care of Livestock during May

Contributed by the Animal Research Division

BLOOD poisoning in hoggets grazing on turnips is becoming an increasingly important problem. Deaths occur from infection with the blackleg organism, which probably gains entry through the mouth. An excellent vaccine, which confers very good immunity, can be purchased in New Zealand. On properties where losses have previously been experienced hoggets should be vaccinated at least a fortnight before they are placed on turnips. The nearest Veterinarian or Livestock Instructor should be consulted about the method of vaccination.

BLOOD POISONING IN HOGGETS

In most districts there is still time to provide good winter grazing by shutting up paddocks and letting them grow during autumn and early winter. Having some pasture cover on paddocks before the first frosts will assist pasture growth during winter. Autumn-saved pasture is invaluable for early-calving cows. It also provides the best insurance against sleepy sickness in ewes. If necessary, feed silage to cows now to enable some paddocks to be shut up. Once the ewes have been tupped they are all the better for being done fairly hard until 3 to 4 weeks before lambing. This also will enable some paddocks to be spelled.

AUTUMN-SAVED PASTURE

The best feed for calves is good fresh pasture, and this can be provided by rotating the calves through the cow paddocks. Good hay is necessary to supplement the sappy young autumn pasture. At the first sign of unthriftiness calves should be drenched with phenothiazine, being given the full dose recommended on the label. Drenching, however, will not be effective unless the calves are properly fed.

UNTHRIFTY CALVES

Sucking of each other by calves is a habit which should be broken as soon as it is detected. The insertion of a bull ring is effective in most cases.

PREVENTION OF SUCKING BY CALVES

As soon as the cows have been dried off arrangements should be made for the milking machine to be overhauled by an expert. Do not install complicated gadgets, but make sure that all parts of the machine are working efficiently. This will not only ensure rapid, trouble-free milking, but is likely to increase production, and will help to reduce mastitis.

MILKING MACHINE OVERHAUL

Distemper in dogs can be prevented in a very high percentage of cases by vaccination. This is best done when the pups are 3 to 4 months of age.

INOCULATION OF DOGS AGAINST DISTEMPER

Red worms can seriously reduce the efficiency of working horses, and are responsible for many deaths in foals. Phenothiazine is a very effective remedy, but is best given under veterinary supervision, as in certain conditions it may prove dangerous. Treatment should be administered before winter.

RED WORMS IN HORSES

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during January and for the 6 months ended 31 January 1957, with comparative figures for the same month and 6 months of 1955-56 have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage Inc. or dec.
January 1957	21,077	387	21,464	—
January 1956	20,985	359	21,344	—
Increase or decrease ..	+92	+28	+120	+0.562
6 months ended 31/1/57	116,982	1,963	118,945	—
6 months ended 31/1/56	118,668	1,984	120,652	—
Increase or decrease ..	—1,686	—21	—1,707	—1.415

Butter in store at 31 January 1957 was 28,800 tons

Note: In addition to the butter graded for export 992 tons of ice cream base were graded for export at Auckland.

CHEESE

Period	White (tons)	Coloured (tons)	Total (tons)	Percentage Inc. or dec.
January 1957	11,140	1,530	12,670	—
January 1956	9,959	1,989	11,948	—
Increase or decrease ..	+1,181	—459	+722	+6.043
6 months ended 31/1/57	52,127	7,454	59,581	—
6 months ended 31/1/56	51,694	8,438	60,132	—
Increase or decrease ..	+433	—984	—551	—0.916

Cheese in store at 31 January 1957 was 23,900 tons

If these figures are converted into butterfat equivalent, there is a decrease of 1.323 per cent. in butterfat graded for the 6 months as compared with the corresponding period of the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place from time to time they are not necessarily a true indication of production trends.

Autumn Pasture Management; Crop Production; Control of Gully Erosion

Seasonal Notes by the Extension Division

MANAGEMENT plans for autumn pasture grazing and winter supplementary feeding should now be given careful attention. The closing of fields to be held for late winter and early spring feeding is closely related to supplementary feeding, and feeding should be started while grass is still growing.

WINTERING DAIRY HERD

AVAILABLE feed should be used so that cows receive a gradually improving diet as calving approaches. At calving the cows should be in good condition and there should be sufficient feed to maintain a nutritious diet from calving until fresh spring growth is available. If the cows have to be used for cleaning up roughage or if the feed position is such that they will have to be short at some time, it is most desirable that this should be early in the period when they are dry, preferably soon after they cease milking. At the beginning of winter consideration should be given to the amount of feed available and estimates made of how long it will be before fresh pasture growth will be available. The poorest feed should be used first, leaving the more nutritious for later feeding. For instance, poor hay should be fed before better hay is used. If the area of saved pasture is small, it is preferable to concentrate on hay feeding first, leaving most of the saved pasture for use nearer to calving. Saved pasture should be break fed with an electric fence so that utilisation is complete. Where a large area of saved pasture is available a portion of it may be fed daily with hay or silage, and as calving approaches the daily ration of pasture should be increased.

—C. M. BLICK

* * *

WHEAT VARIETIES AND SOWING

THOUGH the abnormal weather in the 1952-53 season brought out a weakness in the usually reliable Cross 7 variety, this wheat remains the best general-purpose variety in the South Island. Cross 7 is autumn-sown widely throughout Canterbury, North Otago, and Marlborough, where it does best on medium to heavy soils, but not so well on light or very heavy soils. It stands grazing well and when autumn sown on the heavier soils benefits from early spring grazing. Its general reliability and resistance to lodging and shedding contribute much to the popularity of this variety.

For lighter soils Fife Tuscan is generally the best variety. This variety will also yield well on heavier land, but there it is subject to lodging.

Hilgendorf does well where soil and weather suit it, but it has a much narrower soil-fertility range than Cross 7. It does best on 35- to 40-bushel wheat land and may be grown with success in parts of Marlborough, North Canterbury, and Mid-Canterbury particularly. As the premium for Hilgendorf wheat in the coming season is 2s. per bushel, farmers who have already tried this variety but have discarded it, may reconsider their decision after considering the likely yield of Hilgendorf and the higher premium now offering for it.

On the heavy soils of Waimate and Waitaki Counties Dreadnought has long been the main variety, but already it has been widely replaced by the new variety Arawa. Arawa is a heading wheat resistant to lodging, but because of its inferior baking quality it cannot be regarded as a general-purpose wheat as is Cross 7. It definitely has a place as an alternative to Dreadnought, however.

In the North Island, where wheat is usually spring sown, Tainui is favoured more than Cross 7, though the weak straw of Tainui causes harvesting difficulties. Gabo has shown promise in variety trials and will be widely grown when seed supplies are available.

Spring sowings are also usual in Southland and Otago (except North Otago) and in this area Cross 7 is almost universally sown. Here also Gabo, which is several weeks earlier than Cross 7, has performed well in trials and is a likely future alternative.

* * *

CONTROL OF GULLY EROSION

IN many North Island hill country districts the clearing of the bush has resulted in severe erosion along the water channels which have been cut deeper into the land by the rush of water coming off the hills in heavy rainstorms. The adjoining slopes have been undermined and whole hillsides are on the move. Once developed this form of erosion is most difficult and costly to control.

There is ample evidence about the country that where timely action was taken by individual pioneer settlers with tree planting in the watercourses on country susceptible to gully erosion streams can be stopped from cutting deeper into the soil and the country has remained relatively stable. There are still many hill country areas where gully erosion is not yet bad but where abnormal rainstorms or earthquakes could well start it. Where there is any evidence of this being possible farmers are urged to start the relatively cheap preventive measures which have proved to be so effective.

The remedy recommended is the planting of suitable willow or poplar poles in pairs about a chain apart along all water channels, including those higher up the slopes which carry water only in times of heavy rain. The poles should be 8ft. to 10ft. long, 3in. to 4in. in diameter, and from vigorous trees. Regrowths from previously lopped trees are ideal. The poles should be planted firmly 2ft. to 3ft. deep and at least 1ft. above flood level on each side of the stream. They should be protected from stock and opossums where experience shows this to be necessary. If a start is made along the bigger streams and the planter works upward, suitable planting material will become available for further plantings in the smaller streams and watercourses as the years go by.

Further advice on suitable trees and methods of protection is available from local officers of the Department.

—E. H. H. KELMAN

Solar Extractor for Beeswax; Wintering Hives

Seasonal Notes for the Domestic Beekeeper

BY-PRODUCTS often play an important part in increasing the financial returns of many commercial enterprises, and so it is with the beekeeper. In this article A. W. Bennett, Apiary Instructor, Department of Agriculture, Hamilton, gives a simple method for the domestic beekeeper of turning all odd pieces of comb and cappings into a saleable commercial cake of beeswax.

THE preparation of beeswax for the market by the domestic beekeeper can be very simply carried out by making use of the solar wax extractor. This equipment is very easily constructed and relies on the heat of the sun to melt the wax out of all odd pieces of comb. Cappings can also be reduced into saleable cakes of beeswax by the same means.

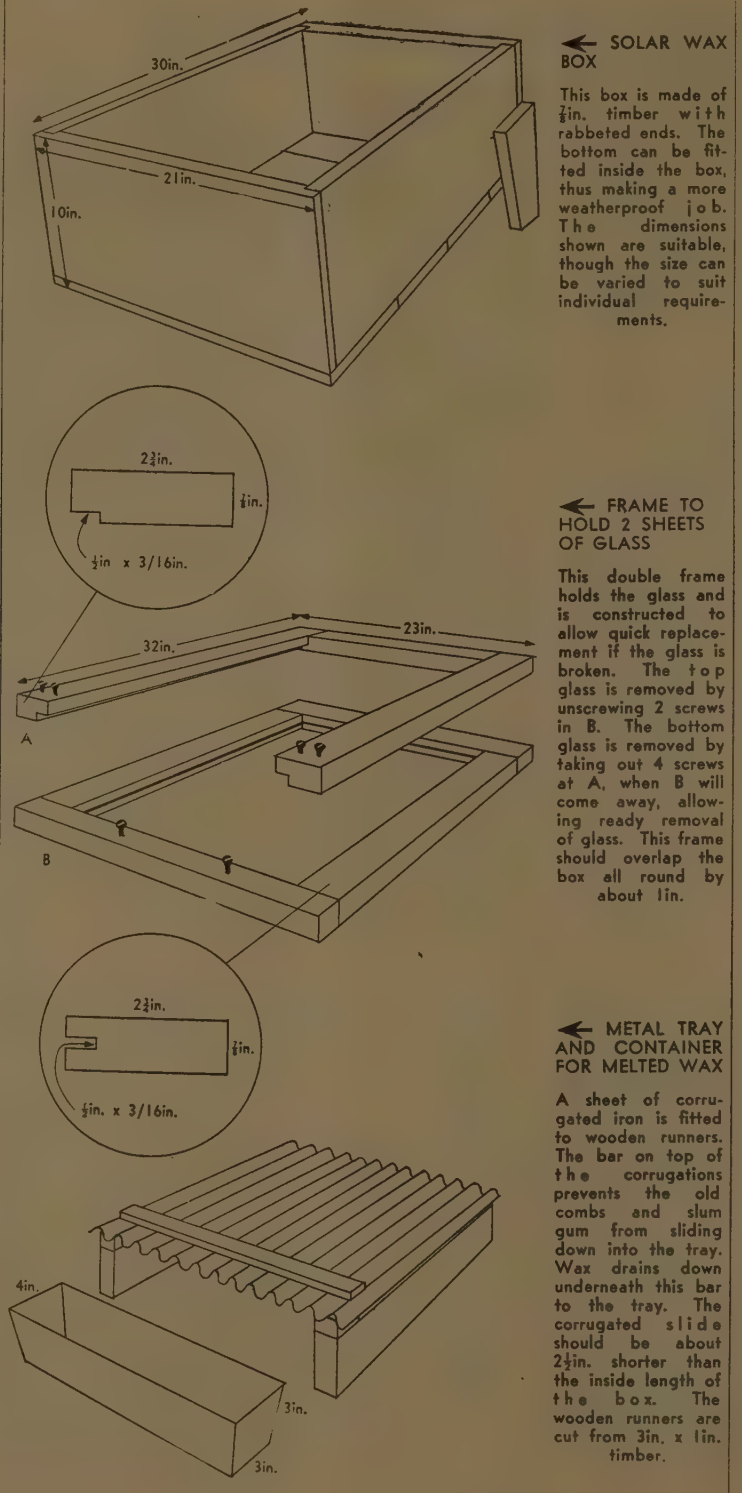
The solar wax extractor is simply a box with a sheet of corrugated iron inside and a small tray to catch the melted wax. Two wooden legs are used to give the box the correct tilt to catch the rays of the sun. To concentrate the heat of the sun on the wax a frame holding two sheets of glass with an air space of about ½in. between them is constructed to fit snugly on top of the box. The diagrams at left show the various parts and method of construction.

The virtue of this type of wax melter is in its ability to deal with the odd pieces of comb as they collect without any fuss or bother. This adds to general tidiness round the apiary and prevents the establishment of wax moth, which can be so destructive to stored combs. This wax extractor can also be used for disposing of cappings.

If care is taken to see that the tray and holding tin are clean, even the honey that is still retained in the cappings can be saved in good order. Sometimes the cake of wax will be perfectly clean, but on other occasions a small amount of rubbish may settle to the bottom of the cake. This can readily be scraped off if the wax is left out in the sun for a short time to soften a little.

Wintering of Hives

At the end of the season hives that have not given a good return under normal conditions should be inspected



← SOLAR WAX BOX

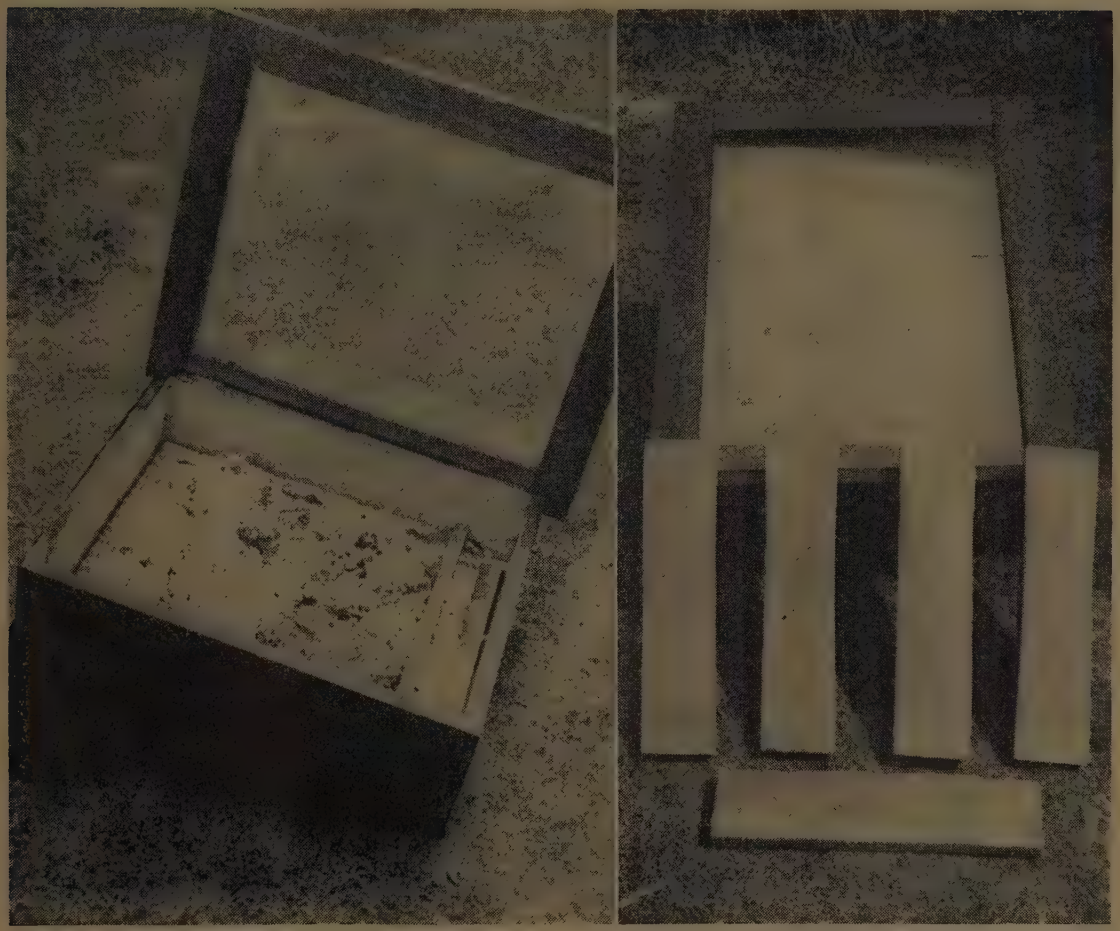
This box is made of ¾in. timber with rabbeted ends. The bottom can be fitted inside the box, thus making a more weatherproof job. The dimensions shown are suitable, though the size can be varied to suit individual requirements.

← FRAME TO HOLD 2 SHEETS OF GLASS

This double frame holds the glass and is constructed to allow quick replacement if the glass is broken. The top glass is removed by unscrewing 2 screws in B. The bottom glass is removed by taking out 4 screws at A, when B will come away, allowing ready removal of glass. This frame should overlap the box all round by about 1in.

← METAL TRAY AND CONTAINER FOR MELTED WAX

A sheet of corrugated iron is fitted to wooden runners. The bar on top of the corrugations prevents the old combs and slum gum from sliding down into the tray. Wax drains down underneath this bar to the tray. The corrugated slide should be about 2½in. shorter than the inside length of the box. The wooden runners are cut from 3in. x 1in. timber.



Left—Solar extractor, showing cappings evenly spread over the corrugated slide. Right—Extractor operating; in front are cakes of beeswax suitable for market direct from the extractor.

for the cause. If the queen is old, a new, young, vigorous queen should be introduced at once. Combs to remain in the hive should be looked over, and any with drone comb showing should be removed and good worker combs given in their place. At the same time the brood should be inspected for any sign of disease.

Hives should be wintered in 2 supers with about 50lb. of stores (honey and pollen). The amount of stores required will vary according to district. The queen should be young and there should be plenty of young bees. Brood and queen should be put in the lower super with pollen and honey on either side of the nest, the balance of stores (honey and pollen) being put in the upper super. The amount of honey in a deep comb well filled will be about 5lb.

Hives should be sound, waterproof, and standing well up off the ground. Grass and weeds should be kept well clear of the entrance. A good idea is to lay a piece of asbestos sheet on the ground in front of the hive.

Hive mats can be removed and two strips of wood about 10in. long and about ⅜in. thick placed across the frames. Mats can then be replaced. This will give easy ventilation and bees will be able to move freely over the tops of the frames in a mild spell. An alternative is to have ¾in. x ⅜in. strips of wood fitted inside the roof, leaving the mat off the hive. This again is an excellent form of passage-way over the frames and gives excellent ventilation, provided the entrance is clear. If the hive entrance is kept clear of weeds and there is good ventilation in the hive, bees will consume much less food, because the inside of the hive will be dry. This is very necessary for safe wintering, and pests such as slaters will be kept down to a minimum. Entrances should be reduced to ⅜in. deep and closed down to about 4in. wide during cold spells.

Floor boards can be given a slight tilt of about 1in. from back to front. This will allow any rain-water or condensed moisture to drain off the alighting board, and so help to keep the hive dry and also prolong the life of the floor board.

PLOUGHING LIME INTO PEAT

MANY failures on peat farms are due to an insufficient distribution of lime to deeper soil layers. Practically all peat soils in New Zealand are acid or very acid, and this means that plant growth on these soils is restricted to the top layer, where growing conditions are more favourable.

DEEP SOIL NEEDS

IT is therefore common practice to apply from 1 to 10 tons of lime per acre, depending on the type of peat and the crop required. Not enough attention, however, has been given on most farms to incorporating the lime in the deeper soil layers, and it is not uncommon to find that conditions in the top 3in. are good, but are far too acid in deeper layers. The deeper the lime is worked in the deeper the roots will be able to penetrate and the greater the moisture reserve which is available to them in the dry summer period.

Peat paddocks can suffer badly from dry summer conditions owing to a lack of available moisture in the top layer of the soil; in deeper layers, however, there is plenty of moisture, and at a depth of 2½ft. the permanent water-table is frequently encountered. There would not be any bad effect from dry summer conditions on these soils if the roots could penetrate far enough to reach moist soil farther down. A water-table of 2½ft. could be within reach of many plants provided soil conditions were favourable.

This last point, however, is the biggest problem. Conditions farther down are generally not suitable for root growth, and roots are unable to grow down to reach the moisture. Because of these adverse conditions pasture plants suffer badly. Many plants die off in summer and are replaced by weeds, particularly sorrel, which grows well on peat soils. It has thick roots in which it can store food, enabling it to survive during poor growing conditions.

RUKUHIA TRIALS

A trial was laid down in the autumn of 1951 to investigate the value of working down lime to varying depths against that of applying lime to the surface only. The paddock was divided into three sections, each section receiving the same quantities of lime and other essential elements. The first section was disced to a depth of 5in.; only the very top of the already partly decomposed peat was turned over, but the deeper soil layers were left untouched. The second section was ploughed 5in. deep, and the third was ploughed 10in. deep. Each section was further divided into a series of six plots. To each plot lime was applied as follows:—

Plot 1: 2 tons of lime, applied to the surface after cultivation.

Plot 2: 2 tons of lime, of which one was applied to the surface after cultivation and one was worked down.

Plot 3: 4 tons of lime, applied to the surface after cultivation.

Plot 4: 4 tons of lime, of which 2 were applied to the surface after cultivation and 2 were worked down.

Plot 5: 6 tons of lime, applied to the surface after cultivation.

Plot 6: 6 tons of lime, of which 2 were applied to the surface after cultivation and 4 were worked down.

HEADING PHOTOGRAPH: Sheep grazing a well-established pasture on raw peat where the lime has been worked down to encourage deep rooting of grasses and clovers.

These lime treatments were repeated for each kind and depth of cultivation. In other words, each section received lime at the rates given for each of its 6 plots.

Where lime was worked down on the disced section it was applied before cultivation and disced in. Discing resulted in reasonable mixing of lime with the top 3in.; farther down, however, the soil remained very acid.

CULTIVATION RESULTS

In the initial stages discing gave better growth during winter than did the ploughed areas. This was probably due to the less decomposed and more acid peat that was brought to the surface by ploughing and made conditions temporarily less favourable.

Production on the three sections was very much the same during the first summer after sowing down. From the first dry summer onward, however, the disced area gradually dropped back and the ploughed area improved. In fact the ploughed area looked so fresh and green in comparison with the surrounding paddocks that visitors thought the pasture must have been spray irrigated. Ploughing 10in. deep brought more raw, undecomposed peat up than did 5in. ploughing, and because of this the area took longer to develop into good pasture, but this section remained best and is standing dry summer conditions better than any of the other sections. Growth on the disced section was poor under dry summer conditions, and gradually the whole pasture deteriorated and is now poor and open with many flat weeds and sorrel. Winter growth on this section became equally poor as a result of slow recovery in autumn, and by the time winter came the pasture was only partly recovered and had a bad weed infestation.

LIME RATE RESULTS

No differences from varying rates of lime could be noticed on the disced section. A dressing of 2 tons of lime raised the pH in the top 3in. sufficiently to obtain good growing conditions. As lime movement is very slow on peat soils and cultivation was only shallow, the pH in deeper layers was not affected, not even by heavy dressings of lime, and this explains why heavier dressings could not improve the pasture production on the disced area.

On the ploughed areas both 4 tons and 6 tons of lime were better than 2 tons, but there was not a pronounced difference between the results of surface application of 4 tons and 6 tons.

RESULTS FROM PLACEMENT

There were obvious gains in the dry summers over the last 2 years from those treatments in which lime was incorporated in the soil of the ploughed area. In particular, the plots where 4 tons of lime were ploughed down and 2 tons were applied to the surface were much better during the dry January-February period in each year.

Pastures treated in this way maintained their greenness and had better production than those in which all the lime was applied to the surface.

SUMMARY AND CONCLUSION

These experiments clearly demonstrated that lime works down very slowly in peat soils and that for good growth of crops and pastures it must be artificially worked into the lower layers of the soil during cultivation.

In practice the amounts of lime which have to be used for good results must be related to initial acidity, and this can be accurately determined only from soil samples. Soils with a pH of 4.2 in the top 3in. and of 3.8 in the 3in. to 12in. layer require a dressing of 2 tons of lime after clearing of the area is completed.

This dressing should be worked down with a plough or rotary hoe, after which a second 2 tons of lime should be applied and worked in lightly by discing or harrowing. It is obvious that when the pH is higher than the figures given above less lime will be required, but the same principle of working at least half of the lime into the soil should be applied.

—F. C. C. HUPKENS VAN DER ELST

Typical hill country on the Taita Experimental Station.

Effect of Phosphate and Molybdenum on the Provision of Nitrogen for Pasture

By R. B. MILLER, Soil Chemist, Soil Bureau, Department of Scientific and Industrial Research, Wellington, and J. G. H. WHITE, Field Experimentalist, Soil Bureau, Taita

IN a lime-phosphate-molybdenum trial on rough, recently burnt hill country on the Taita Experimental Station of the Soil Bureau of the Department of Scientific and Industrial Research some outstanding clover responses were obtained last summer. Nodule development of the clover roots was examined and related to the fertiliser treatments. The results illustrate clearly the vital part played by phosphate and molybdenum in the supply of nitrogen to pasture in this type of country.

THE Taita Experimental Station is in the hills to the east of Taita in the Hutt Valley. The soils are mainly yellow-brown earths and are typical of much of the less fertile hill country of Wairarapa, Wellington, and Nelson districts (see heading illustration). On the experimental area the soil type is Taita silt loam (hill soils). These are problem soils which, despite many attempts at pasture establishment, are still mainly covered in gorse and scrub. The main difficulty has been to get clover growing to supply the nitrogen required by the grasses.

Deficiency in phosphate has been, and still is, the most important factor limiting the development of hill pastures, but within the last few years aerial topdressing has provided a practical means of applying superphosphate. For clover establishment, however, it has been shown recently that molybdenum is also essential. With both superphosphate and molybdenum good mixed pastures have been obtained and fixation of atmospheric nitrogen by the clovers has provided the nitrogen necessary for the grasses. Unsatisfactory clover growth due to soil deficiencies may now readily be overcome, so that in future much more success in farming reverted hill country can be expected.

Experimental Methods

In May, 1954, several acres of dense gorse and manuka on the Experimental Station were burnt and pastures established. Some of the soil changes following the fire have been described elsewhere (1). Immediately after the fire an area was fenced off for fertiliser trials. A light dressing of urea was applied, but no other fertilisers were used until the plots were treated with lime, superphosphate, and molybdenum in August, 1955. The urea was added to give the grasses the nitrogen necessary for establishment. As a wholly organic chemical it leaves no mineral residue that could interfere with subsequent experiments.

The area selected is on a 12-degree slope falling to the west and south. The surface still bears the characteristic unevenness of the original beech forest. The soil profiles vary considerably between the relatively shallow, dry soils of the ridges and the deeper, gleyed, or sometimes slightly peaty soils of the hollows. These changes can occur over a distance of a few feet, so that even small areas with uniform profiles are difficult to find. This variability is not desirable in sites for field experiments, but large areas of New Zealand are like this, so methods have to be found for experimenting on them. One of the essentials is a large number of plots and in this experiment each treatment is replicated eight times. Mathematical techniques have been worked out which enable differences between plots to be analysed, despite the variability.

Because of the large number of replicates required, the plot treatments were restricted to control (no treatment), lime, superphosphate, and superphosphate plus lime. Half of each plot was treated with molybdenum. The rates of application of major elements were heavy (2 tons per acre of lime and 500lb. per acre of superphosphate), as the primary purpose of the trial is to investigate the effect of these treatments on the uptake of other elements by the pasture.

Molybdenum was applied as ammonium molybdate at 2½oz. per acre to study its effect on clover development. On many soils these traces of molybdenum have been found to give

CLOVER RESPONSES TO MOLYBDENUM

A typical control plot with no fertiliser on the right sub-plot and molybdenum alone on the one at left. Without phosphate the cover and growth are poor and there are no differences between sub-plots.

In the first year of the trial a dressing of 2 tons per acre of lime had no significant effect on grass or clover growth. The left sub-plot had molybdenum as well as lime, but this gave no improvement.

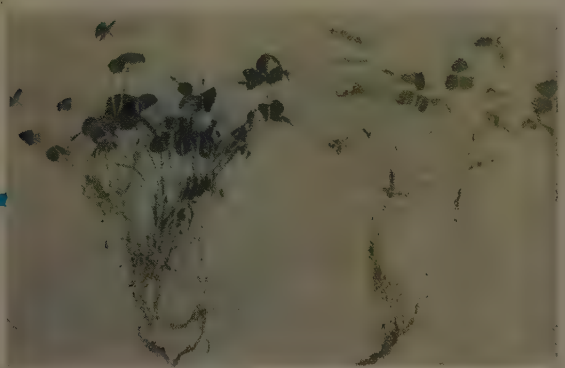
In the plots treated with superphosphate grass growth was vigorous, but clovers grew well only where molybdenum was also added (left sub-plot).

The lime plus superphosphate plots are similar to those with superphosphate alone. The response of clover to molybdenum is shown in the right sub-plot. Good pastures clearly require both phosphate and molybdenum on these soils.

SUPERPHOSPHATE AND
AT TAITA

The clover plants from the control plots are small and green, but with some yellowing in places and occasional red tinges on the edges of the leaves. Plants from the molybdenum sub-plots are no better than those from the controls (right).

←The clovers in the limed plots are as sparse and stunted as those in the control plots and of similar colour. Molybdenum has had no apparent effect on the plants on the left. However, an improvement is expected in the second year.



The vigorous green plants on the left are from the superphosphate plus molybdenum sub-plots. The others, treated with superphosphate alone, are smaller and distinctly yellow.

The molybdenum-treated clovers on the left contrast strongly with the stunted, nitrogen-starved plants on the right. For good clover growth and effective nitrogen fixation both molybdenum and phosphate are essential.

autumn precautions

TVL

BLACKLEG IN HOGGETS

As hoggets are very susceptible to blackleg at the time when their teeth are changing they should be protected against this disease before putting them on to winter feed where the risk of exposure to blackleg is often greater than normal.

PULPY KIDNEY PROTECTION

In those areas where tupping has not been completed it should be remembered that this is the most convenient time to give unvaccinated ewes their first dose of pulpy kidney vaccine. This is necessary to ensure the maximum transference of protection to their lambs when the ewes receive their usual pre-lambing pulpy kidney vaccination.

ALTERNATIVELY all ewe hoggets may be given a dose of TVL COMBINED BLACKLEG PULPY KIDNEY VACCINE before putting them on to winter feed. This protects the hogget against blackleg and at the same time conditions it to respond fully to the pre-lambing dose of pulpy kidney vaccine which is necessary to ensure protection of its lamb against pulpy kidney during the first six weeks of its life.

TVL

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responses equal to those of heavy dressings of lime. This discovery is of great importance for hill country, on which the cost of spreading lime is very high. Before the observations on the trial are considered some of the factors influencing nodule formation on clovers and fixation of nitrogen from the air by clovers should be mentioned.

Fixation of Nitrogen

Fixation of nitrogen from the air by legumes, such as clovers, is done in nodules on the roots of the plants by rhizobia bacteria. These bacteria penetrate the root hairs of the plants and stimulate division of the infected cells, and characteristic nodules develop. The innermost part of an active nitrogen-fixing nodule is packed with bacteria. If such a nodule is sliced lengthwise, this zone may usually be seen as a spot of bright red tissue, the colour being that of a pigment, leghaemoglobin, closely related to the haemoglobin of the blood. If nitrogen fixation has ceased, the red pigment breaks down to a green one. The red colour is good evidence of nodule activity. Another characteristic of an active nodule is the relatively large volume of infected nodular tissue; it may be up to five times that of an inactive one.

The pattern of nodulation on the roots is also useful in determining the effectiveness of the nodules. An ineffective association usually has a large number of small, white, round nodules scattered over the whole system; an effective association has relatively few, large, pinkish, elongated nodules clustered round the crown and top secondary roots.

Nodulation normally takes place at about the time the first leaves are emerging and on pasture legumes nodules will fix nitrogen for 2 to 3 months. Ineffective nodules start to degenerate after a week or so; the tissues soften and brown and are sloughed off.

Some Factors Influencing Nitrogen Fixation

Several factors are known to influence the formation of effective nodules and nitrogen fixation in legumes. Some of these are:—

Bacterial Strain

The first essential is to have an effective strain of a suitable species of rhizobia in the soil. Under normal farming conditions with a fertile soil sufficient rhizobia will be present for nodule formation, but sometimes deficiencies occur in infertile soils or soils sown to pasture after long periods in other crops. Soil inoculation, in which bacteria are added, for example with the seed, is now widely used in many parts of the world. The great value of inoculation in some of the pumice soils of the central North Island has been shown (2).

Physical Conditions

The bacteria whose natural habitat is the soil will fix nitrogen only in the presence of their appropriate host plants. Usually the more fertile the soil is the greater their numbers will be, but they are able to tolerate a wide range of conditions. They are organisms which need air, but can tolerate soil atmospheres with an oxygen content as low as 5 per cent. without loss of activity.

Most rhizobia grow best at temperatures of about 80 to 90 degrees F., but can function at temperatures down to 35 to 40 degrees.

Moist conditions are more favourable for their growth than dry conditions, but even extreme drying will not completely destroy them, though it will certainly reduce their numbers and activity. The rhizobia are in fact extremely persistent and even without legumes being grown will remain for many years in most soils.

Acidity

All species of rhizobia will tolerate any degree of alkalinity likely under normal soil conditions. Their limit of tolerance is about pH 9.6 (neutral pH 7). In tolerance of acidity they vary somewhat, but the limits of most species are between pH 4 and 5. Legumes have been known to grow satisfactorily at pH 4.5, but below pH 5 nodulation tends to be greatly reduced. This may be a factor limiting clover growth in some moderately to strongly acid soils.

Lime

The effect of lime is undoubtedly closely bound up with that of pH, but calcium is also important as a nutrient, both for the legume and the rhizobia. Legumes are more sensitive to calcium deficiencies than are grasses and it has been shown that the rhizobial population becomes inactive when soils are low in calcium. The diminishing activity of the nodules in acid conditions is probably related to the lack of calcium, though other factors will be involved.

Despite the preference of the plants and rhizobia for high-calcium conditions, excess liming should be avoided, as it is liable to reduce the availability of other essential elements, notably iron and boron. Legumes are particularly high in boron, which has an important function in nodule formation and seems to be associated with calcium absorption and the movement of carbohydrates within the plant.

Nitrogen

One of the most important factors affecting nodule activity is the ratio of carbohydrate to nitrogen in the plant sap. Under normal conditions a steady supply of carbohydrate comes from photosynthesis in the leaves and a corresponding amount of nitrogen for protein formation is taken up by fixation and from the soil. The proportions may be altered by increases or decreases in either carbohydrate or nitrogen.

The proportion of carbohydrate to nitrogen, for example, will become too low if the carbohydrate supply is reduced by the plants being eaten down. If this occurs, the nitrogen demand becomes less and fixation in the root nodules will decrease. An increase in soil nitrogen will give the same effect. On the other hand increased carbohydrate supply or a reduction in available soil nitrogen will lead to an increased demand for fixed nitrogen by the plant, the activity of the nodules will increase, and more nitrogen will be fixed.

The proportions of carbohydrate to nitrogen also affect the formation of nodules. When the nitrogen supply is relatively low the root hairs are characteristically deformed and rhizobia are able to penetrate into the roots and form nodules. The plant thus has in nodule formation and activity a sensitive control for balancing its supply of carbohydrate and protein.

In a mixed pasture this mechanism also controls the total nitrogen supply of the soil. If the nitrogen level falls, the clovers become more vigorous than the grasses, their proportion in the pasture increases, and soil nitrogen comes back to normal. If the soil nitrogen is increased, for example, by application of nitrogenous fertiliser, the proportion of the clovers will decrease and the nitrogen supply by fixation will be reduced until, once again, equilibrium is reached.

Phosphate

For effective nodulation and nitrogen fixation a number of nutrient elements are essential. Phosphorus is one of these. It is important in nodulation because it has a strong stimulating effect on the bacteria, tending to keep the population high and in movement, hence improving the possibilities of root infection and of nodulation. Phosphorus affects the rate at which a plant can synthesise protein; if phosphate is deficient, synthesis is slow, nitrogen builds up in the plant, and fixation ceases. Plants low in phosphorus are stunted and dark green, owing to their high content of chlorophyll.

Molybdenum

There are two processes in which molybdenum is involved in nitrogen utilisation. In clovers and other nitrogen fixers it is required in the actual fixation process. Without it the nodules are ineffective and, unless there is some outside source of nitrogen, the plants are stunted and yellow. The quantities required are very small.

Clovers and Root Nodules

1. Without superphosphate the clovers were small and the root nodules sparsely scattered. They were small, round, and white, indicating that they were not fixing nitrogen.

2. With superphosphate but without molybdenum the plants were larger, but the leaves were yellow and nitrogen starved. Root nodules were plentiful, but were not fixing nitrogen.

3. With both superphosphate and molybdenum the plants were large and green. The scattered root nodules were large, elongated, and pink, showing that they were actively fixing nitrogen.

Two and a half ounces per acre of sodium molybdate, which contains 1oz. of molybdenum, is a common dressing that may supply the molybdenum requirements of a pasture for several years. Responses have been obtained with applications 50 times smaller. However, lack of molybdenum does not inhibit nodulation itself; there may be plenty of nodules, but without molybdenum they will not fix nitrogen.

In clovers, and in grasses as well, there is another process requiring molybdenum. It occurs in the series of reactions within the plant in which nitrate is converted to protein. The quantities involved here are even smaller than those in the fixation process, but nevertheless are essential to the growth of the plant. In nutrient solutions concentrations of molybdenum as low as 1 part in 1000 million have proved sufficient for plant growth.

Because of the different levels of molybdenum required for the two processes it is possible to have soil molybdenum levels high enough for nitrate utilisation but too low for nitrogen fixation. In these conditions soil nitrogen is available to the plants, but none is obtained from the air. Only when soil molybdenum is very low will both nitrate utilisation and nitrogen fixation be affected. At this stage growth will be severely restricted and nitrogen deficiency symptoms strongly developed.

Sulphur

Sulphur has an important influence on the nitrogen economy of the plant, but it does not seem to be concerned in the nitrogen-fixation process. Its importance, like that of phosphate, lies in the process of the conversion of soluble forms of nitrogen to proteins in the plant. If sulphur is lacking, nitrate builds up and nitrogen fixation is depressed.

A more comprehensive survey of factors influencing nitrogen fixation has recently been published by FAO (3).

Observations on Experimental Plots

In the spring of 1955 very clear phosphate responses in the grasses were noted on the experimental plots at Taita, and these were measured by cutting, drying, and weighing the grass at the silage stage in November. After this there was little growth of grasses, but white clover began to come away and after heavy rain in early January 1956 grew vigorously. In the last fortnight in January a number of observations on the clover, including root examinations, were made and photographs taken. Some of these are shown in this article. They indicate the value of superphosphate and molybdenum for good clover growth and effective nitrogen fixation.

The colour illustrations (see pages 338 and 339) show typical plots with the various treatments. Half of each plot has received molybdenum. Clovers from the plots are also shown. In the sub-plots receiving superphosphate and molybdenum the clovers were thick and the plants tall and green. Without molybdenum, but with superphosphate, they were scattered and stunted. The leaves were small and had a distinct yellow tinge. Without phosphate, whether molybdenum was supplied or not, clover was very sparse and the plants small. The leaves were green with a little yellowing in places and sometimes there was a red tinge round the leaf edges.

Clover plants and their root nodules are shown on page 342. Where superphosphate and molybdenum had been applied the clover growth was good, the plants green, and the nodules large, elongated, and well distributed through the upper roots. These nodules had a reddish tinge and when cut showed the red central spot which indicates that they are actively fixing nitrogen. Without molybdenum clover growth was poor, the plants yellowish, and the nodules small, round, and profusely scattered throughout the root system. They were white and inside were white or brown, showing growth and degeneration without the fixation of nitrogen.

Without superphosphate all the growth was poor. Not only were the nodules small and ineffective, but there were relatively few of them.

Responses to lime in addition to molybdenum have been obtained by the Extension Division of the Department of Agriculture on this type of soil and will probably appear here in the second year of the trial. In the first year there was no evidence that lime had affected either the rate of growth or the composition of the pasture.

Effect of Moisture

One of the main variations on the trial area, owing to the uneven surface, is in water, the moister hollows and drainage channels being clearly defined in dry periods. A close, irregular mosaic of dry and wet areas is in this way superimposed on the regular pattern of plots. It is thus possible in the observations to take into account the effects of moisture over and above those of the various fertiliser treatments.

Though the rainfall through January was well above average, there were at the time of the observation marked differences in growth between the dry ridges and the damp hollows. It was clear that the plants could take advantage of the moisture only when phosphate and molybdenum had been applied; without these the growth was poor, even in the moister parts. It was also clear that in the drier parts the plants could not take full advantage of the phosphate and molybdenum that had been applied. Growth was better than on the control plots, but not nearly as good as in the damp hollows. Conditions were, however, not dry enough, even in the driest parts, to inhibit nodulation of the clover roots where phosphate had been applied.

Conclusions

The results of the experiment show that on the Taita silt loam, one of the less fertile soils of the hill country of central New Zealand, good grass growth depends on adequate superphosphate, and clover growth relies also on molybdenum topdressing. For a good mixed pasture both are essential on these soils.

Both phosphate and molybdenum are necessary for effective nitrogen fixation by rhizobia bacteria in clovers. They also have other functions in the plant, for instance, in the utilisation of nitrogen, but these are not primarily connected with nitrogen fixation.

The efficiency of the fixation process may be gauged to some extent from the appearance of the root nodules. If they are large, elongated, and pinkish, the soil probably contains adequate phosphate and molybdenum. If there is heavy nodulation, but the nodules are ineffective, the phosphate level is probably high enough and some other factor such as molybdenum is limiting development. Low phosphate status is indicated by few, ineffective nodules. The plants, though small, may be quite green.

The application of these tests must be made with caution, as other factors may be involved. High soil acidity, a high level of soil nitrogen, sulphur deficiency, and lack of suitable strains of bacteria, for example, will all restrict nodulation. In the hill soils of the strongly leached yellow-brown earth group, however, phosphate and molybdenum are probably the most important factors limiting the production of nitrogen by bacterial fixation in clover root nodules.

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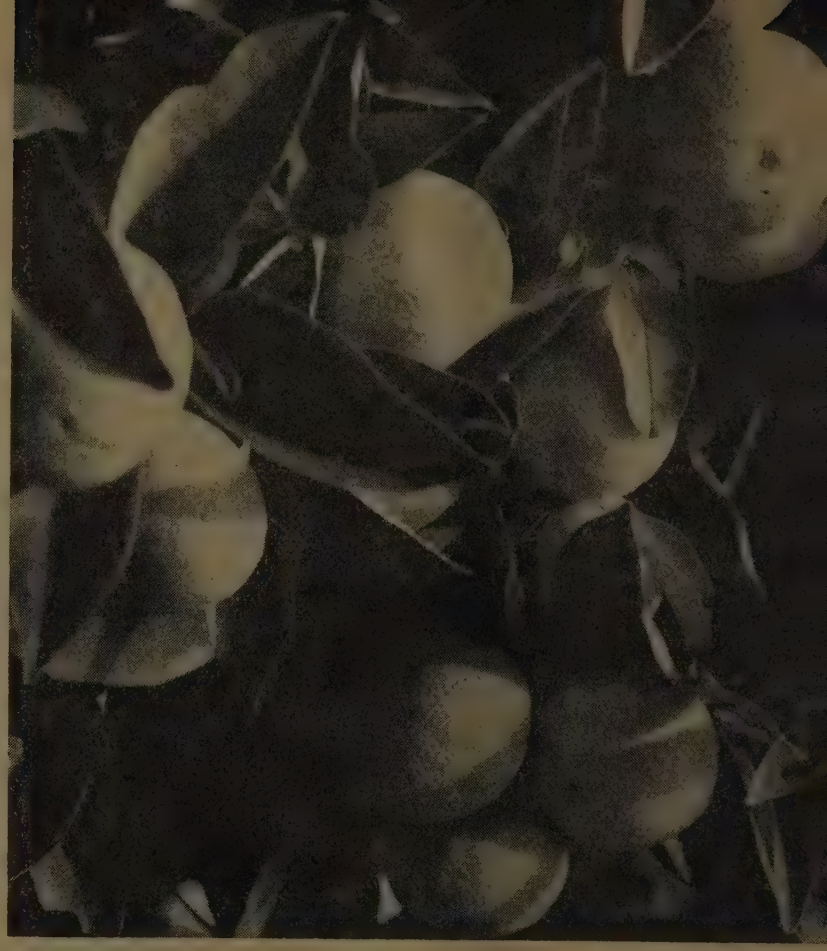
Citrus in the Home Garden

By W. A. FLETCHER,
Citriculturist, Department of Agriculture, Auckland

THERE are few foods as nutritious and as popular in the diet as the various citrus fruits, and perhaps not the least of New Zealand's many natural advantages is that these fruits can be grown in home gardens over a large part of the North Island and some of them in many sheltered places in the South Island even as far south as Christchurch. Apart from contributing to the family food supply, citrus trees with their evergreen, glossy foliage, fragrant blossoms, and brightly coloured fruits also make very ornamental shrubs which can add to the interest and attractiveness of any garden. In this article advice is given on how to select citrus trees for the home garden and how to establish and subsequently care for them for best results. Advice is also given on harvesting and storage of the fruit.

CITRUS trees can be grown with relatively little effort. The main essentials for their successful culture are a warm, sunny position sheltered from severe frosts and prevailing winds, and adequate water during dry periods. They prefer a rich, deep, rather light soil, but with good care they can be made to produce on any well-drained soil.



Fruit of the sweet orange variety Best Seedless.

GUIDE TO VARIETIES

The citrus fruits best known in New Zealand are lemons, grapefruit, oranges, and mandarins, but others such as tangelos (hybrids of grapefruit and mandarin), limes, and kumquats can also be grown in this country.

To guide the home owner who wishes to plant a few citrus trees the following varieties are recommended and their characteristics briefly described.

Lemons

The principal varieties of lemons cultivated in New Zealand are Lisbon, Eureka, Villa Franca, and Genoa, all known as "standard" varieties, and the Meyer lemon.

Lisbon is a vigorous, prolific, moderately thorny, fairly large tree which has a tendency to bear its heaviest crop in late winter and spring, though some fruit is available all the year round. The variety is slightly more resistant to cold than are the other standard varieties, but it is not as hardy as the Meyer lemon. The Lisbon lemon can be grown to advantage on the trifoliata rootstock, which restricts the tree to a size more suitable for the average home garden and increases its hardiness.

Eureka is a thornless and somewhat smaller tree than Lisbon. It is prolific, comes into bearing at an earlier age, and bears a better summer crop than Lisbon.

Villa Franca is a lemon of the Eureka type which is a heavy summer bearer.

Genoa is another good Eureka type of lemon. It is a smaller tree than the others, bears heavily while still young, and produces a heavy summer crop. It is well suited to most home gardens.

The Eureka, Villa Franca, and Genoa varieties are generally better suited than Lisbon to most home gardens in warmer localities because of their smaller tree size and their superior habit of yielding heavier summer crops. The trifoliata rootstock is not recommended for these varieties.

Meyer is a hardy type of lemon that can be grown in cooler districts where other lemons do not succeed. It is not a true lemon but a natural hybrid, probably between a lemon and a sweet orange. The tree, which is smaller than Eureka or Lisbon, is nearly thornless and matures most of its fruit during winter and early spring, but generally some fruit can be obtained all the year round. The fruit is of medium size, has a milder flavour than true lemons, and is very juicy. The fruit turns almost orange in colour when fully mature. The denser, darker green foliage of this variety makes it a more ornamental tree than other lemon varieties. Unlike other lemons, the Meyer is often propagated from cuttings and grows well on its own roots.

The only varieties of grapefruit which have proved satisfactory under New Zealand conditions are the so-called New Zealand grapefruit and the Wheeny grapefruit.

Varieties of the types imported from America and Jamaica such as **Marsh Seedless** and **Triumph** grow quite well under New Zealand conditions, but owing to insufficient heat in the New Zealand climate the fruit produced is virtually useless, being extremely thick skinned with very little juice and poor flavour. **These types of grapefruit cannot be recommended under any circumstances for growing in New Zealand.**

New Zealand grapefruit: This variety, which is the most commonly grown citrus in New Zealand, is not a true grapefruit but is a natural hybrid, probably between a shaddock and a sweet orange or a mandarin. It was introduced in about 1855 by Sir George Grey at Kawau Island in the Hauraki Gulf and was called "Poorman's orange" because of its slightly bitter flavour but heavy bearing qualities. The name New Zealand grapefruit was later given to thin-skinned, high-quality strains of Poorman's oranges. The most commonly grown strain is often referred to as **Morrison's Seedless** grapefruit. This is a self-sterile strain which produces more or less seedless fruits when isolated from other citrus varieties. When Morrison's Seedless grapefruit is grown close to seedy varieties of citrus such as lemons, some sweet oranges, and the Wheeny grapefruit in particular, cross pollination occurs and the fruit loses its seedless character.

Lippiatt's is another good variety of the New Zealand grapefruit type which arose from a different source from the Poorman's orange introduced at Kawau.

The New Zealand grapefruit is a hardy, vigorous, prolific, fairly large tree with dense, dark green foliage and can be grown to advantage in the average home garden on trifoliata rootstock. The fruit is medium sized to large, a deep yellow colour, juicy, and with a tangerine-coloured flesh that is pleasantly sub-acid and slightly bitter in flavour. It is suitable for marmalade from May until July and for dessert grapefruit from August to December.

Wheeny grapefruit is a late variety, ripening from November to March, which originated from a seedling growing in Australia and was first introduced into New Zealand about 1935. The fruit is pale yellow, large, thin skinned, and very juicy, somewhat similar in appearance to American and Jamaican grapefruit varieties. The Wheeny is a very vigorous, large tree which tends to alternate a heavy crop one year with a light crop the next. It is not as hardy as New Zealand grapefruit and requires warmer and more protected situations. When propagated on trifoliata rootstock the tree is restricted to a more suitable

An 8-year-old Washington Navel orange tree on trifoliata rootstock.

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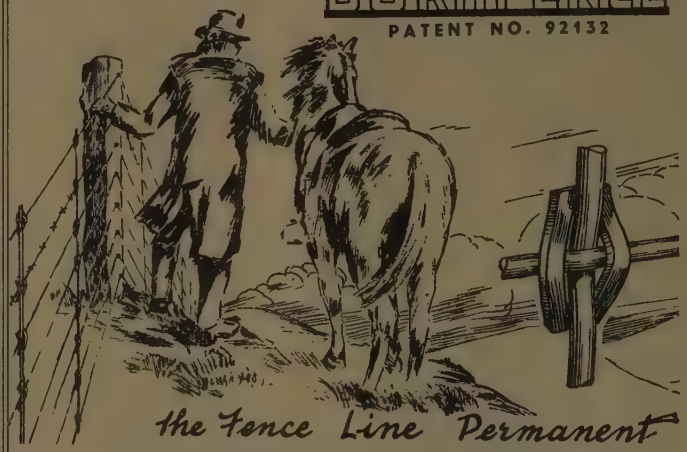

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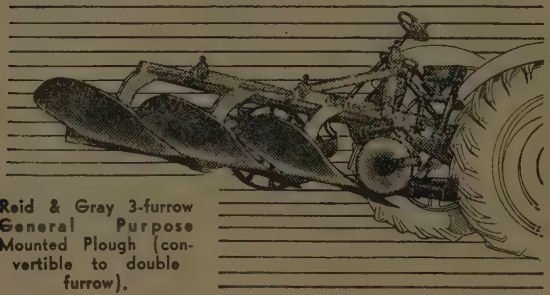

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A 5-year-old Clementine mandarin tree on trifoliata rootstock.

size and hardiness is increased. A distinctive characteristic of this variety is the puckering of some of the leaves, which is a natural condition not caused by any disease.

Sweet Oranges

Contrary to popular opinion excellent oranges can be grown in the warmer districts of New Zealand provided the right varieties and rootstocks are chosen. Where room allows, several trees of different varieties can be planted to spread the harvesting season of these fruits. If the number of trees must be limited, it is important to plant only early or mid-season varieties, as late-maturing varieties rarely produce really high-quality fruit in New Zealand.

Navel Oranges

Washington Navel orange is an early variety, maturing about August. The fruit is seedless and of excellent flavour and can be left on the tree for 2 to 3 months after it has matured, especially if the tree is on the trifoliata rootstock. The tree is medium in size and vigour.

Carter Navel is an excellent strain of the Washington Navel type which is especially recommended.

Other navel oranges such as **Robertson Navel**, **Groverly Navel**, **Navelencia**, **Thompson Navel**, and **Golden Nugget** are all different strains which have arisen as bud variants of the Washington Navel orange. These varieties are not generally recommended, as they are inferior to good strains of Washington Navel and Carter Navel in tree vigour, cropping habits, or fruit quality.

Valencia Oranges

Valencia and **Lue Gim Gong** varieties are closely related and are of interest mainly because of their late season, mid-October to December, though fruit with normal juice content can frequently be picked at any season of the year. The fruit is medium in size and seeds are few. The fruit often does not develop full flavour or colour under New Zealand conditions, and if left on the trees tends to turn green again and often dry out.

The Valencia does very well on trifoliata rootstock, with which fruit quality is very considerably improved. There is some evidence, however, that the Lue Gim Gong variety is sometimes stunted on trifoliata rootstock.

Other Oranges

Best Seedless is a variety which originated in New Zealand and is well suited to the home garden. The tree, which grows larger than the Washington Navel, is particularly suited to propagation on the trifoliata rootstock. On this rootstock the tree is a good cropper and the fruits, which often have navels, are of very high quality with good flavour and melting pulp, and ripen from late August until November. On other than trifoliata rootstock the tree is a shy bearer. Some strains of this variety are prone to produce a proportion of small, misshapen fruits.

Ruby Blood is a mid-season variety, ripening from September to November, which produces an orange of fine colour and good juice content and flavour. The fruit is seedy and small to medium. The blood colour develops only on exposed fruit in hot seasons. The trees are medium sized and are prolific croppers, but show a tendency to alternate a heavy crop one year with a lighter crop the next.

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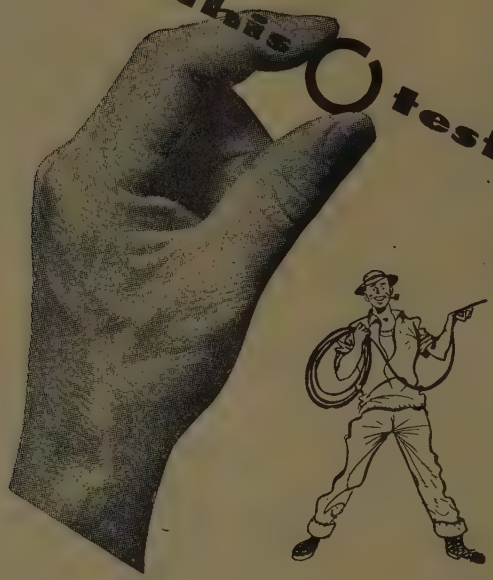

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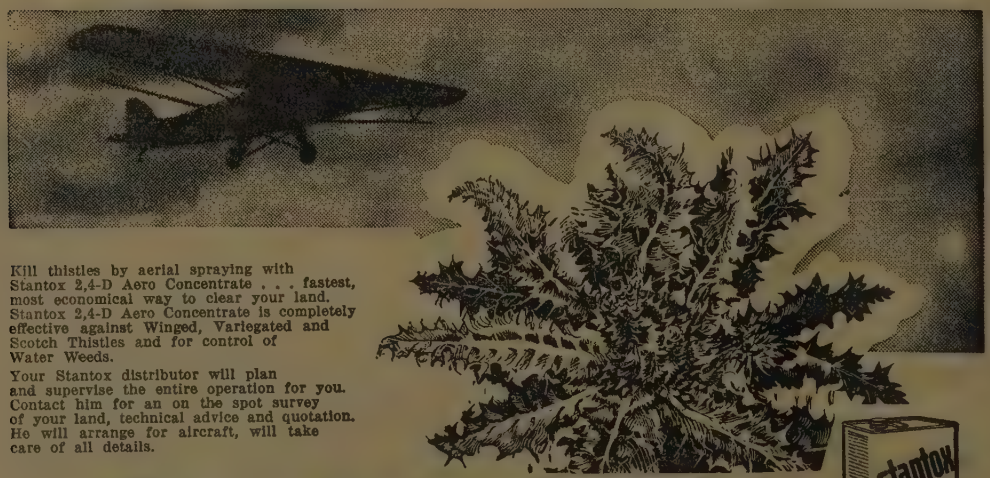

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St. Michael is another mid-season variety ripening from September to November. The fruit is medium sized and seedy, with very juicy, melting pulp. The trees are medium sized and are prolific croppers.

Mandarins

The name tangerine is sometimes used overseas for red-skinned varieties of mandarins, but this name is not generally used in New Zealand.

The easy peeling and sectioning of mandarins are particularly appealing to children. Mandarin trees are generally more cold resistant than other commonly grown citrus varieties, though the fruit is as readily injured by cold as are sweet oranges.

Satsuma or **Unshiu** varieties are the most frost resistant of any cultivated citrus variety and can be grown where summer temperatures are too cool for other citrus. The trees are generally small with an open, spreading habit. The fruit is seedless, medium in size, and ripens during June and July, which is earlier than any other orange or mandarin variety. These mandarins have a fairly short harvesting season and if they are left on the tree too long after maturing, they are liable to become excessively puffy and dry.

Silverhill is a vigorous, heavy cropping strain of Satsuma mandarin which is especially recommended for planting.

Wase (pronounced wah-zay) is another named strain of Satsuma of good fruit quality, but the tree is a weaker grower than Silverhill.

Clementine fruit is small to medium, highly coloured, and usually has few seeds. If this variety is grown close to other seedy varieties, however, such as lemons or Wheeny grapefruit, seediness is often greatly increased through cross pollination. The Clementine ripens early, but a few weeks later than Satsumas. Unlike Satsumas the fruit often remains juicy and palatable for several months if left on the tree. The tree is medium in size with fine branches and dense foliage.

Thorny is one of the best flavoured of all mandarins. The fruit is small to medium and moderately seedy. The tree is medium in size and tends to be dense and bushy. The fruit ripens mid-season from about September, but remains palatable and juicy even if left on the tree until late in the year. The variety has a strong tendency to biennial cropping.

Kara is an excellent, rich flavoured mandarin. The fruit, which is medium to large, usually moderately seedy, but sometimes seedless, ripens late from October to December. The tree is medium sized and moderately open and drooping in habit, and is especially recommended for propagation on trifoliata rootstoek. When the tree is grown on sweet orange rootstock the fruit may dry out before ripening fully. This variety also tends to have an alternate bearing habit.

Miscellaneous Citrus Varieties

The following out-of-the-ordinary kinds of citrus may be of interest to some gardeners.

Tangelos

The tangelo group of citrus fruits consists of hybrids of the mandarin with either the grapefruit or shaddock and they are more or less intermediate in character between the parent species. Several named tangelo varieties are being tested in New Zealand, but the only variety at present commonly propagated by nurserymen is the **Tinuera**. The fruit, which is yellow and about the size of a common sweet orange, is slightly drawn out at the stem end. It ripens late, about October to December. The pulp is richly flavoured, only slightly bitter, and very juicy. The tree is vigorous and grows as large as a sweet orange tree.

Seminole is another promising tangelo variety originating from Florida which may be available in limited numbers from nurserymen within the next few years.

Ugli: Fruit of this variety, which is generally spoken of as a tangelo, has been imported from Jamaica in recent years and has impressed many people with its fine quality. Unfortunately propagation material of this variety is not available in New Zealand. Some so-called Ugli trees have been raised from seed and offered for sale in New Zealand, but it is doubtful if many or any of these are true to type. In any case fruit is unlikely to be produced for 8 to 10 years or longer from trees grown from seed, and until then their worth cannot be evaluated.

Tahiti (or Persian) Lime

The fruits of the Tahiti or Persian lime are similar in appearance to lemons, except that the skin is smoother. The pulp is very acid, highly flavoured, and almost seedless. Crops ripen in spring, but odd fruits mature all year round. The variety is not quite as hardy as Eureka and Lisbon lemons and should be grown only in warmer localities. The trees, which are not as prolific as lemon trees, are low, spreading, and vigorous, with dense, dark green foliage.

Kumquats

Kumquat trees, which are small and shapely with dense foliage, make very fine ornamental shrubs. If grown in tubs and on trifoliata rootstocks, they may be kept at a height of from 2ft. to 4ft. for many years. Kumquats are very hardy. The small, golden yellow to orange fruit is oval, round, or oblate, depending on variety, and makes excellent marmalade or conserve. A variety called **Nobilis** is a prolific cropper and is especially recommended. Other named varieties are **Ngami** and **Marumi**, but these crop heavily only after a long warm season.

Shaddocks or Pummelos

Though shaddock or pummelo trees will grow and crop in New Zealand, the fruit never attains high quality and the trees cannot be recommended for planting except as novelties.

CHOOSING TREES

To avoid disappointment later careful thought should be given initially to the selection of citrus trees for the home orchard. Points to consider are room available, soil type, and climate, as these will influence the choice not only of variety but also of the rootstock for the trees.

Many home gardeners are unaware that the cultivated citrus tree is compound in nature. The root system of the tree only is grown from pips and later a bud from the chosen variety is united with the seedling. The root system is known as the rootstock, and the top portion which develops from the united bud is known as the scion. The process by which bud and rootstock are united is described as budding. The kind of rootstock used can profoundly influence a citrus tree's cropping, fruit quality, tree size and hardiness, adaptability to various soil conditions, and resistance to certain diseases.

Rootstocks

In New Zealand three main rootstocks are used at present, namely, sweet orange, rough lemon (or citronelle), and trifoliate orange (commonly known as trifoliata). Recently another rootstock known as Yuzu has also come into limited use.

Sweet orange rootstock is suited to medium loam and sandy soils and produces vigorous trees of standard size. Good crops of quality fruit, especially lemons and grapefruit, are obtained with this rootstock. Its main faults are its susceptibility to the effects of drought conditions and to root rot and collar rot diseases.

Trifoliata rootstock shows several characteristics which are definitely advantageous for home garden citrus trees, especially oranges and mandarins grown under most New Zealand conditions. It can be used successfully with all the varieties recommended in this article except Eureka, Villa Franca, Genoa, and Meyer lemons.

It is highly resistant to collar rot and root rot diseases and can be used more successfully than other rootstocks on heavy soils. It is also more resistant to drought and is hardier than other rootstocks, enabling trees worked on it to withstand lower ranges of temperature.

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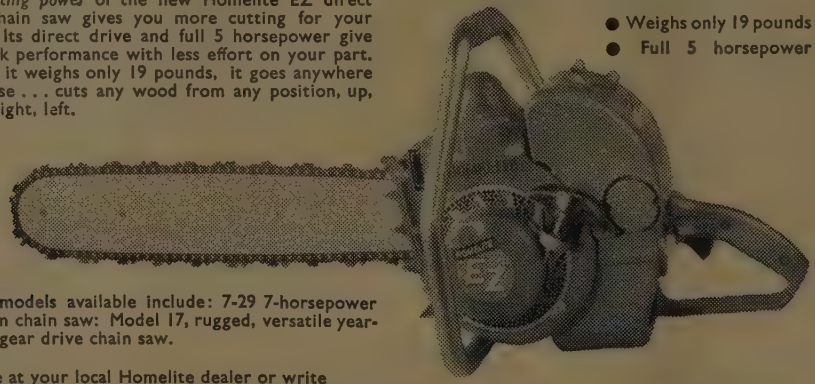

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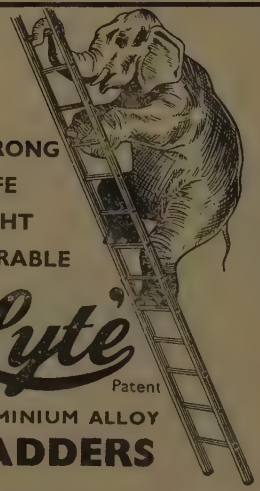

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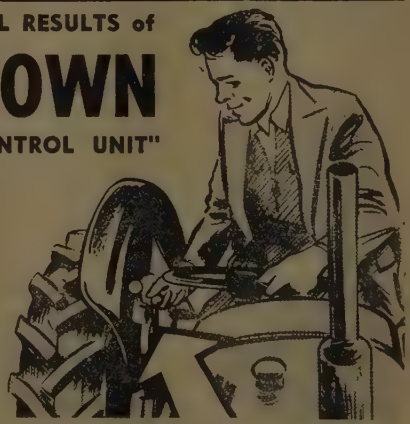

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Smaller trees are produced on trifoliata, making closer planting distances possible, which is a decided advantage in most home gardens. Despite their smaller size, these trees yield more consistent crops as heavy as and often heavier than those of larger trees of the same varieties on other rootstocks. Moreover, fruit quality is always superior and fruit can usually be held on the tree much longer without deterioration.

Most home gardeners are impatient to obtain fruit from their trees as soon as possible and trifoliata induces trees to bear at a much earlier age than do other rootstocks.

It is important to note that the trifoliata rootstock is not well adapted to alkaline or limy soils. Its use should be avoided in such conditions and the sweet orange rootstock used instead. Trees on trifoliata roots also require to be liberally supplied with manures or fertilisers, especially on infertile soils.

Rough lemon (or citronelle) is quite suitable as a rootstock for all lemons, but it is not recommended for New Zealand grapefruit and Wheeny grapefruit. Sweet orange and mandarin varieties should not be used on this rootstock. Fruit from trees on rough lemon roots is often coarse and usually poor, lacking in flavour and juice. Rough lemon is also susceptible to root rot and collar rot diseases.

Yuzu is used to some extent in Japan, especially as a rootstock for Satsuma mandarins, and it may have some promise here for oranges and mandarins. So very little is yet known of the performance of citrus varieties on this rootstock in New Zealand that no recommendations can be made at present.

BUYING TREES

When it has been decided what varieties are required and what rootstocks would be most suitable, the next step is to buy the trees from a reliable nurseryman, specifying not only the variety but also the rootstock required.

The best tree to buy is one with a healthy, vigorous top which has been grown on in the nursery for 1 or 2 years after budding. Any trees with poor, hard, stunted growth or showing signs of scale and other insect pests or diseases should be avoided.

Many home gardeners hoping to gain time often prefer extra-large nursery trees 4 to 5 years old, especially if they possess the allure of a few fruits already growing on them. Usually nothing is gained and frequently much is lost by buying such trees. Younger, smaller trees are nearly always better able to adjust themselves to the shock of transplanting than the large, older trees and they usually will outgrow and come into full bearing sooner than the older trees.

The precocious Meyer lemon and trees of all varieties on trifoliata roots may set fruit in their second year of growth in the nursery. If such fruit is found on a newly bought citrus tree, it is best removed at planting time to give the tree a better chance of quickly establishing itself and developing a sturdy framework capable of carrying large crops as soon as possible.

Trees on trifoliata roots are slower growing than trees on sweet orange or rough lemon roots and may be smaller when offered for sale. Provided the trees are not runts, this is no disadvantage, as they will readily establish once planted and will come into earlier and often heavier bearing than larger trees on other stocks.

PLANTING

Selecting the Site

Before a citrus tree is bought a sheltered, warm, sunny site should have been chosen for it, as citrus trees exposed to prevailing winds will never succeed. Full use can be made of shelter from existing buildings, fences, hedges, and trees or shrubs.

Drainage

Good soil drainage is also essential for citrus trees. In heavy clay soils this can be improved by judicious use of open, tile, or scoria drains. Some gardeners mistakenly seek to improve drainage by simply digging a large hole for each tree and filling the bottom with old tins and rubble. This actually makes conditions worse by creating a sump in which excess water accumulates in the wet season, often with fatal results. This scheme may be satisfactory if adequate drainage away from each hole can be made, but it is better to improve drainage generally rather than attempt to improve very restricted areas.

With very heavy soils it may be of advantage to plant the trees in mounds raised a few inches above ground level to avoid waterlogging of roots in wet winter weather. With this method particular care must be taken for the first few years to keep the tree well watered in hot summer weather to prevent the roots from drying out.

Planting Distances

Citrus trees must be given ample room for best development. Space required varies from 12ft. to 18ft., depending on the variety, rootstock, and growing conditions, and is least for mandarin and navel orange trees on trifoliata roots. More room is necessary for all varieties on sweet orange or rough lemon roots and greatest space is needed with Lisbon lemons and grapefruit trees.

Time to Plant

Citrus trees can be planted from April to September. In warmer localities autumn or even mid-winter planting can be undertaken, but in colder areas planting should be delayed until August or September, after the danger of frost has passed.

Citrus trees are sold with their roots balled in soil and wrapped with sacking, and they should be planted in their permanent positions as soon as possible after being received. If the trees cannot be planted immediately, they should be held in a sheltered, shady position, preferably with the ball buried in soil to prevent it from drying out.

Preparing to Plant

Holes for planting trees normally need only be deep enough to take the ball and wide enough for easy filling. In new gardens, however, or where the soil has never been cultivated and is hard and compacted, the whole area in which the trees are to be placed should be deeply dug over before planting. With acid soils the whole area should then be given a dressing of carbonate of lime, and if time permits, a green crop of blue lupins or Algerian oats should be grown and dug in before trees are planted. Over-liming may be detrimental if trees on trifoliata rootstocks are to be planted. In rocky soils the bottom of the hole should be probed to locate any large stones, which should be removed. When holes are being dug the topsoil should always be kept separate from subsoil. Before planting, 1lb. of blood and bone or bonedust thoroughly mixed with the soil in the bottom of the hole will prove beneficial. Other fertilisers can be applied after the tree is planted.

Planting

Generally the sacking should be removed from the ball of the tree before it is planted, but care should be taken to disturb the soil round the roots as little as possible. If, however, the ball is composed of a heavy clay soil and has become hard, it should be soaked in water and gently loosened before planting. Any damaged roots which are visible should be trimmed carefully and the tree then set in the hole. The roots are then carefully spread out and the hole refilled with topsoil only, care being taken that the earth is firmly tamped round the roots as they are covered so that no air pockets are left.

With heavy clay soils in particular the sides of the hole should be broken down to avoid creating a sump, as mentioned earlier, which may fill with water in wet weather. To ensure that the soil is in close contact with all the roots it may sometimes be desirable to settle the soil with water in addition to tamping it.

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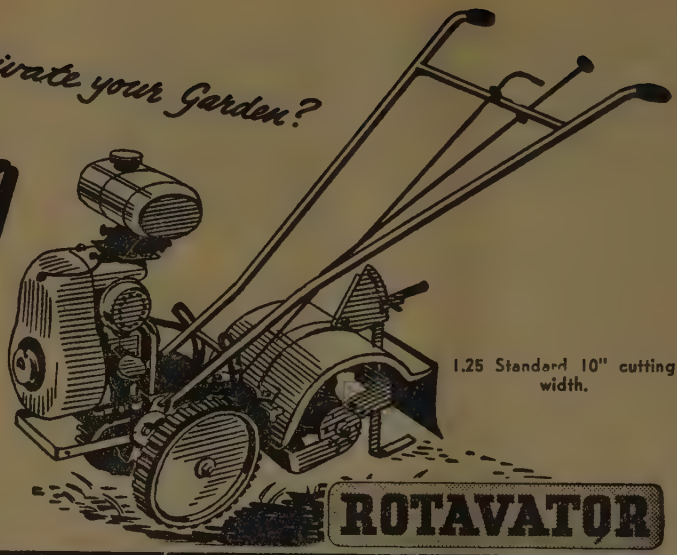

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It is most important that citrus trees should not be set too deep, or they are likely to be killed by collar rot, a fungous disease which frequently develops where the soil comes in contact with the bark of the trunk, especially near the bud union. The trees should be planted so that the uppermost roots branch out at, or even slightly above, soil level.

Sometimes citrus trees are heeled in after digging and held for some time before they are sold. Trees obtained in spring may have new roots showing through the sacking of the ball. In these circumstances it may be best to retain the sacking to avoid damaging the new roots. Nevertheless, the sacking should be untied round the base of the trunk and folded back to expose the soil of the ball before planting.

CARE AFTER PLANTING

Fertilising and Manuring

A common cause contributing to the failure of many citrus trees in home gardens is inadequate plant foods for their needs. These foods can be supplied by animal manures or commercial fertilisers.

A deficiency of nitrogen, which results in a stunted general growth and a yellowing of leaves, is more common in citrus than a deficiency of other plant nutrients. Nevertheless, it is sound practice in most home gardens to use so-called complete fertilisers containing the three major nutrients, nitrogen, phosphorus, and potassium.

A fertiliser which is suitable for citrus trees can be made up by mixing 5lb. of sulphate of ammonia, 4lb. of superphosphate, and 1lb. of muriate of potash. As a general guide this mixture should be applied annually at 1lb. per tree for each year of the tree's age from planting up to about a maximum of 10lb. per tree per year.

Blood and bone is very commonly used by the home gardener as a fertiliser, and those preferring to use this material should apply it at 1½lb. per tree for each year of the tree's age up to about 15lb. per tree per year. Blood and bone is not a complete fertiliser, however, because it provides only nitrogen and phosphorus nutrients. In some circumstances it may be wise to supplement the blood and bone with dressings of muriate of potash at 1lb. for every 15lb. of blood and bone used.

Stronger-growing trees may require larger quantities, and less vigorous trees smaller quantities, than those recommended above. Trees with trifoliata rootstocks, despite their average smaller size, need generous supplies of fertilisers to be grown with success, and suffer much more severely from neglected nutrition than trees on sweet orange roots.

Fertilisers are best applied in at least two dressings each year. The first, providing about two-thirds of the yearly total, should be made in August, and the other third should be applied in February.

Poultry and other farmyard manures also provide all the nutrients required by citrus trees and are ideal if available. The actual nutrients are much less concentrated in farmyard manures than in commercial fertilisers and therefore they must be applied in much heavier dressings. Poultry manure should be used at about 50lb. per tree for a large, fully grown tree, and other manures such as horse or cow dung can be used at even double this rate.

Animal manures give best results if applied in autumn or early winter, but can be used as they become available if regular supplies are handy.

Manures and fertilisers should be spread evenly under the tree and to about 1ft. to 3ft. beyond the spread of the branches, depending on the size of the tree. If the tree is surrounded by lawn, fertilisers should be spread over the lawn, but should be watered in to avoid burning the grass.

Mulching

Best results are obtained with fertilisers where there is an ample supply of decaying organic matter and moisture in the soil.

Grass clippings, weeds, leafmould, compost, and other organic material can be thrown under the tree, **but great care should be taken to keep the mulch away from the tree trunk**, as otherwise moist conditions are created which are ideal for the onset of bark diseases which are often fatal.

Mulches of organic matter are important not only for their nutritional value but also to conserve soil moisture during the hot, summer months. They also markedly affect soil structure, improving aeration and drainage of heavy soils and increasing the water holding capacity of light, sandy soils. It is not necessary to remove mulch when fertilisers are being applied.

Liming

Animal manures and sulphate of ammonia often have an acidifying effect which can be neutralised by dressings of agricultural ground limestone or hydrated lime. The latter material is quicker acting and more satisfactory for small home orchards. Lime is best applied annually in autumn and a rate of 6oz. to 8oz. per square yard should be satisfactory in most instances, but over-liming of trees on trifoliata rootstocks should be avoided.

Cultivation

Citrus trees are often grown as ornamental specimens in lawns without any soil cultivation. In those conditions, because of competition from the grass, the trees require more water in dry weather and also need large quantities of fertilisers. It is best to cultivate a small area round the trunk to obviate the need for mowing close to the tree and thus probably injuring the bark.

If the ground round the trees is kept cultivated, it should not be worked deeply. The main value of cultivation is to keep weeds under control and thereby reduce the competition for soil moisture and plant food. Cultivation to a depth of 1in. or 2in. is sufficient and will destroy comparatively little of the shallow root systems of the trees.

Where mulching with organic materials is a regular practice, very little cultivation is needed, because the decaying mulch serves much the same purposes as will cultivation. Pulling or hoeing out the few strong-growing weeds not smothered by the mulch may be all the cultivation needed.

Pruning

Generally the removal of healthy foliage or interference with the natural habit of growth of citrus trees should be kept to a minimum. Lemon trees and dense, bushy mandarin varieties, however, benefit from more pruning than do other kinds of citrus trees.

Citrus trees generally grow naturally into well-shaped trees and in the early years generally the only pruning of value is that of shoots which arise from the trunk below the main branches. If any strong "water shoots" or other undesirable growths appear which might compete with the main limbs or which show signs of developing into large branches crossing through the centre of the tree, they can also be removed or pinched back to avoid big cuts later in the tree's life.

Once orange and grapefruit trees begin bearing they normally should require very little attention other than the control of water shoots and the removal of dead and diseased wood.

In addition to this treatment lemon trees, including the Meyer and dense bushy varieties of mandarin such as Clementine and Thorny, benefit from a moderate annual thinning of the fruit-bearing wood which will reduce the crop but improve the size and quality of the fruit. Mandarin varieties such as Satsuma and Kara require little pruning and should be treated in much the same way as oranges.

Some of the branches of lemon trees, especially Eureka types, may require

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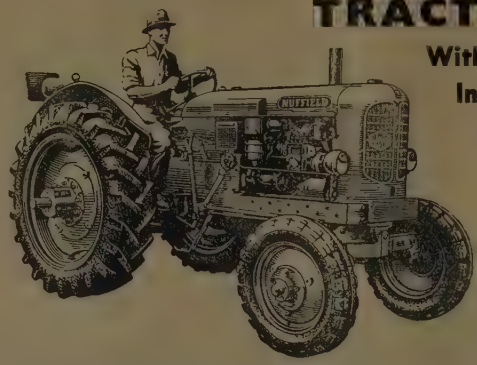

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shortening, as if they are permitted to grow too long, they tend to become spindly and weak. This subjects fruit to excessive rubbing and scratching and may also result in heavily laden branches being broken by the wind.

Pruning to raise the "skirt" of a tree should not be excessive, as a large proportion of the best fruit is produced on this part of the tree, but it is desirable to keep the foliage clear of the ground.

Opening the tops of bearing trees by removing large branches to let in light is not recommended, as this only causes the tree to use up plant food to replace the lost foliage and results in a reduction in crop yields. It also increases the risk of injury by frosts.

As citrus trees age it often becomes necessary regularly to remove older crowding branches and laterals that are declining in vigour to stimulate the growth of new fruit-bearing wood and maintain the cropping capacity. Pruning for this purpose will be of benefit only if proper attention is also given to manuring, soil management, and disease control.

Citrus pruning can be done at almost any time and is most conveniently carried out when the fruit is being harvested. In cool localities and where any severe cutting has become necessary to renovate neglected, debilitated trees, it is safer to delay pruning until spring, after the danger of frost has passed.

When pruning of citrus trees becomes necessary the correct procedure is to thin out laterals at intervals along a branch or cut a branch back to a lateral so that a reasonably strong terminal growth always remains. In pruning this way the new growth stimulated is well distributed and fruitful. On the other hand, pruning a branch to leave a cut end without any terminal growth should be avoided, as new growth is stimulated only from a few buds near the cut and its development into fruit-bearing laterals is delayed. When removing larger branches make cuts close to the parent branch and avoid leaving stubs, as they will not heal over and may be attacked by borer and disease.

CONTROL OF PESTS AND DISEASES

Because of the relatively thick and tough skins of citrus fruits, their eating quality is not so readily affected by pests and diseases as is that of many other fruits. Nevertheless, the appearance of the fruit may be made very unattractive and the tree itself may suffer markedly from insect and fungous attack if control measures are neglected.

A number of pests and diseases attack citrus trees in New Zealand, but those which are most common and serious are listed in the table at the top of the page with symptoms and control measures.

COMMON PESTS AND DISEASES ATTACKING CITRUS TREES

Pest or disease	Symptoms	Control (see spray programme)
Black aphid	Infects young twigs and curls leaves, especially in spring and summer	Spray with nicotine sulphate
Citrus borer	Perhaps the most common and most serious citrus pest. Twigs are killed by grubs boring in wood and holes are made in trunk and larger branches	Systematically prune out all dead and dying twigs. Inject petrol into holes and plug the holes with soap or putty
Leaf-roller caterpillar	Leaves are attached to fruit or each other with silky threads	Spray in December and January with lead arsenate, 1oz. to 4 gallons, or DDT 50 per cent. wettable powder, ½oz. to 4 gallons
Thrips	Cause russeting of fruits	Spray with nicotine sulphate
Scale insects	Several species attack citrus. Sooty mould often present	Spray with summer spraying oil in February. If only hard wax scale is present, delay spraying until May
Brown rot	Leaves are brown, wilted, and fall; fruit is decayed	Spray with bordeaux or other copper spray in May and repeat if necessary
Collar rot	Leaves are yellow and fall prematurely. Bark on trunk is dead or discoloured, particularly at soil level. Gumming may occur	Cut out all infected tissues and paint with a bordeaux paste. A few weeks later when the wound is clean and dry apply bituminous paint
Verrucosis	Fruit and leaves are distorted and covered with light brown scabs	Spray with bordeaux in November and May

SPRAY PROGRAMME

Period of application	Treatment (quantities for 4 gallons)	Disease or pest
Petal fall of main blossom (about November)	Bordeaux mixture (4oz. of bluestone, 5oz. of hydrated lime)	Verrucosis and other fungous diseases

(Spray in October, November, and December with same mixture if verrucosis has been troublesome.)

Early February	Summer oil, 1 pint	Scale insects, sooty mould
Late in May	Bordeaux mixture (as above) plus summer oil (as above)	Brown rot Hard wax scale

Repeat the bordeaux mixture spray at any time during winter and spring if brown rot appears.

If aphids are present, nicotine sulphate, 6 teaspoons in 4 gallons, should be added. (See section below about dangers in use of nicotine sulphate.)

Bordeaux mixture is prepared by dissolving the bluestone in 2 gallons of water. The hydrated lime is mixed to a thin paste and added slowly to the copper solution while it is stirred. Finally water is added to make 4 gallons of spray.

Mix copper (bluestone) sprays in wooden or copper containers if possible. If these sprays are mixed in iron containers, they should not be left in them for long because of rapid corrosive action.

Proprietary copper compounds are available which when used at 3oz. to 4 gallons of water are satisfactory substitutes for bordeaux mixture.

Oil sprays should be thoroughly mixed with an equal quantity of water before being stirred into the full quantity of water.

Arsenate of lead should be mixed with a little water before being put into the mixing container.

Precautions with Nicotine Sulphate

The following precautions should be observed when nicotine sulphate is being used:—

1. Avoid contact of the concentrated material with the skin and mouth.
2. Wash off any liquid spilt on the skin, using soap and running water.
3. After spraying clean all exposed parts in a similar manner.
4. Keep the liquid out of reach of children.
5. Avoid eating, drinking, or smoking during spraying operations.
6. Cease spraying should headaches or tightness of the chest develop.

Practically all spray materials are more or less poisonous. Precautions must be taken to keep them away from children and to avoid taking even small quantities internally.

HARVESTING

Generally little or no fruit can be expected for the first 3 or 4 years after a citrus tree is planted. Though trees

on trifoliata roots are very precocious and may sometimes bear in the first year after planting, it is best to remove the fruits before they reach acorn size to prevent them from overtaxing the young tree and thus restricting its growth. In the first few years the aim should be to grow a big and vigorous tree which can carry large crops later.

From about the fourth year onward there should be increasing quantities of fruit.

It is perhaps not generally known that oranges, mandarins, and grapefruit do not ripen as do other fruits after being cut from the tree and that if they are not of desirable eating quality at the time of picking, they never will be. In New Zealand citrus fruits may be fully coloured and yet far from mature, so care is necessary to avoid picking the fruit too early. The correct harvesting season for various citrus fruits is described in the section about varieties, but generally the earliest sweet oranges and New Zealand grapefruit required for dessert are not properly ripe until August. Other varieties ripen even later, and only certain mandarin varieties such as Satsuma and Clementine are ready earlier.

The best way of holding citrus fruits is to "store" them on the tree. Most citrus fruits continue to improve in quality on the tree for a considerable period after they first became suitably mature for eating. If left on the tree too long, however, quality and flavour will eventually deteriorate and the fruit may lose its juice.

With lemons the definition of maturity is rather vague and generally it is simply associated with the availability of extractable juice, regardless of size or colour of the fruit. Lemons may be harvested throughout the year and should be picked when they are about 2¼in. in diameter. Standard lemons (which include Lisbon and Eureka) in particular, if left too long on the tree, are often oversized and coarse and are not amenable to curing, a natural process whereby skin thickness is reduced and juice content is increased after the fruit is harvested.

If it becomes necessary or desirable to pick citrus fruit and store it for future use, the secret of success is simply to harvest and handle it with the utmost care. Even the slightest injury to the skin of the fruit will provide an entrance for decay organisms. If the skin is uninjured, fungous attack is resisted and the fruit will often keep for many weeks in good condition.

Citrus fruit should not be pulled from the tree, as there is a danger of tearing the peel next to the stem button and subsequent infection of the injury by moulds. The tree is also likely to be injured by the tearing and breaking of twigs, thus opening the way for borer and disease infections.

The fruit is best removed from the tree with sharp clippers, preferably with a blunt, rounded nose. The fruit is first removed with a few inches of stalk adhering by cutting back to a healthy new lateral shoot. A second cut is then made to remove the stalk close up to the stem button. The first cut forms an essential part of the pruning of the tree and by it the tree can be kept compact and fruitful and freer from dead and worn-out fruiting wood. The second cut should be neatly done, because protruding stalks are liable to damage fruits with which they come in contact during handling. When the fruit is removed care is necessary to avoid scratching it with the fingernails or on thorns and dead twigs in the tree.

Citrus fruit should never be dropped, but should be handled like eggs and laid gently into the containers, which should be dry, free from soil, nails, splinters, and twigs, or anything that is likely to injure the fruit. If fruit has to be emptied from one container into another, it should be poured carefully. Picking is best delayed until several days after any heavy rain and the fruit should be thoroughly dry at the time of harvesting. Fruit which has fallen to the ground should be kept separate from picked fruit and used first, as it is more likely to have been injured and therefore more subject to decay.

STORAGE

Citrus fruit is best stored in clean wooden boxes or cardboard cartons and should be held in a well-ventilated but not draughty place with a cool, even temperature.

It is an advantage to wrap each fruit in paper, as this helps to isolate decaying fruit and also helps to reduce wilting and shrivelling of the fruit.

The fruit should be inspected periodically and all fruit showing signs of decay carefully removed.

Lemons can usually be held off the tree for much longer periods than other citrus fruits, especially if they are picked in a green or silver condition. When held at warmer temperatures lemons will soon colour and at the same time skin thickness will be reduced and juice content increased.

With all citrus fruit successful long storage is primarily dependent on very careful handling to prevent injuries from the time of picking until the fruit is used.

"Science in New Zealand": F. R. Callaghan, ed.

A HANDBOOK has traditionally been issued in the host country for meetings of the Australian and New Zealand Association for the Advancement of Science. The holding of the thirty-second meeting of the Association in Dunedin in January of this year was the occasion for the publishing of the issue under review. The previous meeting of the Association in New Zealand was the twenty-third, in Auckland in 1937. During no other period comparable to the intervening 20 years has the impact of science on all phases of national life been more intense, and the occasion was an appropriate one to present, in the form of a symposium of articles by leading scientists, a picture of the advances made and a review of the scope of research. In tracing the development of the particular branches of science they cover, contributors to the volume have not been restricted to the 20 years since 1937, and the book, in necessarily brief form, is a history of scientific development in this country.

The wide range of interests affected should ensure general public interest in the volume, but it is a pity that its usefulness, particularly for the student, is marred by errors to which editor, publisher, and printer contribute. All no doubt had their difficulties in dealing with a composite work from more than 20 contributors that had to be ready in time for the congress, and the book has many evidences of printing hurriedly prepared and inadequately checked. It is to be regretted that when all too few publications are available that could be useful sources of information on national development, there should be reservations about a potentially outstanding one into the planning of which much time and effort must have been put.

The association of science with practice has particular significance in agriculture in New Zealand, and much of the book should be of interest to farmers as illustrating the many ways in which science, directly and indirectly, has helped to shape the evolution of agricultural production and processing methods in this country.

—*G.J.N.*

A. H. and A. W. Reed. 22s. 6d.

Citrus Borer

By H. S. TAYLOR,
Horticultural Inspector,
Department of Agriculture, Tauranga

IN his effort to produce better fruit man's fight against insect pests has been carried on for generations. Over the years control measures have advanced from traps, lures, and poison baits to chemical sprays which paralyse and kill instantly, but even the most efficient of these modern sprays has its limitations, and even with the help of scientific and mechanical aids the fruit grower fights a continual battle against the insect world.

AMONG the most difficult pests to control are those such as boring insects whose natural habits take them beyond the reach of sprays and poisons. A particularly destructive insect of this type is one which has become known in New Zealand as the citrus borer (*Oemona hirta*, Fabr.). It is one of the native longhorn beetles and of the same family as the well-known huhu beetle which often invades homes in summer evenings. The adult of the citrus borer is a long, narrow, reddish-brown beetle about 1in. to 1¼in. long and the wing cases are clothed with tiny, light-brown bristles. These bristles are easily discerned with an ordinary hand lens and make identification fairly certain. The beetle flies mainly at night and the flight period extends from July throughout summer and autumn until February, with peak numbers appearing in November. It has apparently not yet spread to overseas countries. It is unknown to citrus growers in Australia or the United States of America.

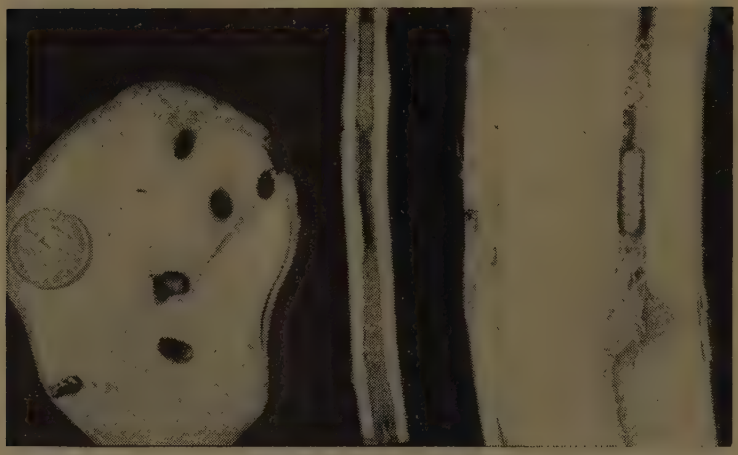
Upper—Citrus borers, showing variations in the sizes of adult beetles. Lower—Ichneumon wasps. This species is the chief parasite of the citrus borer.

Debilitated condition of a 20-year-old lemon tree heavily infested with citrus borer.

Host Plants

In pre-European days, before the introduction of fruit trees from the Old World, this borer fed on native trees such as kowhai, rangiora, kohuhu, and manuka, but over the years, with the steady reduction in the area of native bush, it has extended its attacks to a wide range of cultivated trees and shrubs and has become one of the most serious pests of citrus trees; hence the name by which it is commonly known today.

Its method of attack is to gain entry into a limb of a tree through a broken twig or some other injury and to bore down through the centre of the limb or else around it in a twisting burrow, but always keeping well beyond the range of man's most effective weapon, the spray gun. In the larva or grub stage (see upper illustration on page 358) it spends 12 months or more tunnelling through the limb of a tree, progressing from twigs into the main branches. Its presence in the tree is not hard to detect, as sooner or later the foliage of the infested branch begins to wilt because of interference with the supply of sap. Also, closer examination of the tree will reveal quantities of powdered wood issuing from holes bored at intervals down the limb. This is a certain indication of the presence of this pest. If left undisturbed, the larva continues down the branch and into the trunk of the tree. Severe infestations



Transverse and longitudinal sections of lemon tree limbs, showing citrus borer larvae.

may be fatal, as the flow of sap is greatly reduced and the tree debilitated beyond recovery (see lower illustration on page 358).

Life Cycle

Some research work has been done on this pest, but its life cycle is still not fully known. Every citrus grower in this country, however, is fully aware of its destructive habits and must be continually on the watch for its work in the orchard.

The adult beetle lives for about 5 to 6 weeks, during which the female is fertilised and lays eggs. As many as 70 eggs may be laid singly or in small groups in bark crevices or in cuts such as pruning scars and other mechanical injuries. From 10 to 13 days after they are laid the eggs hatch and the larvae begin to feed on the cambium layer of the wood surrounding them. It is often noticed that only one larva is found boring in each twig; this is possibly because the first grub to hatch kills the others.

Control

Biological control is the natural method of checking the spread of various members of the insect world and ensuring a balance of population. The chief parasite of the citrus borer is a species of ichneumon wasp (*Mesostenus albopictus*) (see upper illustration on page 357), which is fairly common in New Zealand where citrus trees are grown. Its control of citrus borer, though not adequate, is valuable.

Because spraying is of little or no effect in the control of borer, other methods must be used. All small limbs which are infested should be removed and burnt. The burning should be done as soon as possible after removal of the limbs from the tree to make certain that all larvae are destroyed. If the infested branches are left lying about the orchard, there is the risk that some of the larvae in them which are sufficiently advanced may reach maturity and take flight.

A cheap and effective type of pressure can for injecting disinfectant or petrol into a borer-infested tree.

When one of the main branches which cannot be removed or the trunk of a tree becomes infested the borer holes should be cleaned out with a piece of fine wire and then with a pressure can injected full of a cresol type of disinfectant fluid diluted with an equal quantity of water (see illustration at left). Motor spirit is also effective. The holes are then plugged with putty, soap, or clay to keep the fumes in the larval galleries. If the disinfectant or petrol touches the larvae, death is speedy. If it does not actually make contact, the fumes in the confined space are usually sufficient to cause death.

Trees should be inspected and treated in this manner several times throughout the year, a constant war being thus maintained against the persistent attacks of this pest.

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M. H. Dye, "Studies on the Anatomy and Biology of *Oemona hirta* Fabricius"; M.Sc. thesis, University of New Zealand, October, 1950.

Protecting Seed Potatoes from Tuber Moth

IN the dry 1955-56 season South Island potato crops were more widely subjected to attack from the potato tuber moth than ever. It is likely that as a result of this build-up in the moth population there may also be attacks by the moth on the 1956-57 season's crops. Where there has been evidence of the potato moth in the field, therefore, it is desirable to protect seed potatoes which have to be stored.

Seed potatoes may be protected from attacks by dusting them with 1 per cent. DDT dust at ¾lb. per sack. This treatment can be carried out by third filling each sack with potatoes, sprinkling ¼lb. of DDT dust over them, filling the second third of the sack with potatoes, and then repeating the process. Finally the sack should be filled and topped off with the remaining ¼lb. of DDT. Subsequent handling should distribute the dust over the tubers, but if the potatoes are to be stored where treated, it may be advisable to agitate the potatoes and dust as the sacks are filled. Table potatoes should not be treated with DDT.

Seed potatoes should be stored under dry, sheltered conditions with protection from frosts and wet weather. Proper ventilation is another essential, and ventilation can be improved by stacking on raised platforms or on gratings. Wet potatoes should not be stored in sacks. When potatoes are handled care should be taken to prevent even slight injury to the tubers, as extensive damage from dry rot can result in storage.

—*P. R. BARRER,*
Instructor in Agriculture,
Department of Agriculture,
Christchurch

Planning Piggery Layout

CONSIDERABLE savings in time and effort are achieved in milking sheds of the new, improved designs. These designs are the result of careful examination of the work involved at milking time to eliminate wasteful practices and equipment, and, when coupled with a simplified work routine, not only increase farm productivity, but make the work easier and more attractive. It is logical that after the milking shed has been improved the piggery should receive similar attention. This article on planning piggery layout by E. D. Edwards, Technical Officer, Department of Agriculture, Wellington, is intended for those farmers who want to spend the least possible time with their pigs and yet pocket as much money as their methods and efforts entitle them to.

THERE is little purpose in providing well-designed housing and layout unless there is sufficient enthusiasm to adopt good feeding and management methods. Some farmers should be amazed that their pigs do so well under frightful conditions and that the owners have put up with this state of affairs for so long. Dozens of farmers will say that they do not like pigs, but at least the pigs' full revenue-producing capacity is realised and good facilities and attention enable them to show their worth.

The tendency in the past of putting the piggery on any piece of land unsuitable for other purposes often led to poor results. Cheap housing and fencing were soon neglected because it was so difficult and unpleasant to move through the quagmire which developed on badly drained land. The hired or the family worker who attended the pigs came to hate the very sight of them, and spent the least possible time with them. Though in the last 10 years or so tractors and improvement in milking-shed routine have made farm work less arduous, there is by no means adequate labour available. Moreover, though dairy farm work has become a little easier because of the extent of mechanisation, most owners and the assistance they have find their day fully occupied and, as in the past, pigs often suffer through lack of adequate attention.

Study of Some Typical Layouts

An indication that pigs on many farms are not getting the attention they warrant is the presence of long-standing accumulations of dung and urine in and round pens. These are to be seen in and about even comparatively new and costly houses. What can be done to make pig keeping more attractive to the farmer and still give the pig a fair deal?

One approach is to seek the best layout and methods of working it to ensure that all the work done is really effective. Every farmer should and can with benefit adopt this approach to all farm operations.

None of the various layouts to be analysed later can be claimed to represent the last word in efficiency, as layouts are bound to be improved to meet prevailing circumstances. The analysis aims to arrange four typical layouts according to their ease and economy of working.

At first a number of farms were visited at three periods in the year, during which a complete record of the daily times and distances walked for various chores at the piggery were obtained. The farmers also agreed to keep production figures for the year. However, a comparison of layouts on this basis was not very accurate owing to large differences between farms in the times for performance of the same tasks.

To eliminate these differences due to management, the analysis was tackled in another way: Average times for the various tasks on the above farms were used and were applied to four typical (though not actual) layouts. Each of those adopted was considered to be stocked identically. To complete the picture the food available and fed to each class of stock was assumed to be the same (skimmed milk), and a programme of daily work desirable for each layout was determined. The analysis took into consideration the type and amount of work required at different seasons of the year, six methods of managing each layout, and farms stocked both at 5-sow and 10-sow level.

Description of Layouts Compared

Waikato paddock system: As an example of extensive layout the Waikato paddock system was chosen. Here paddocks 1 chain by 1½ chains are serviced by a central race 18ft. wide. The layout was considered to have feed troughs at convenient positions in each paddock. Where milk was carried to troughs in buckets it was obtained from one tank on the 5-sow farms or from two tanks on 10-sow farms. Only one centrally placed tank was used when milk was piped to troughs.

Wooden houses on runners were situated near the far end of each pad-

A paddock layout on badly drained land.

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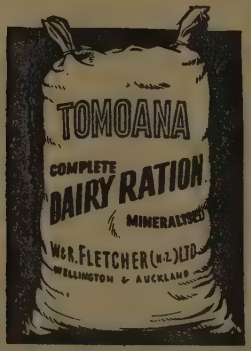

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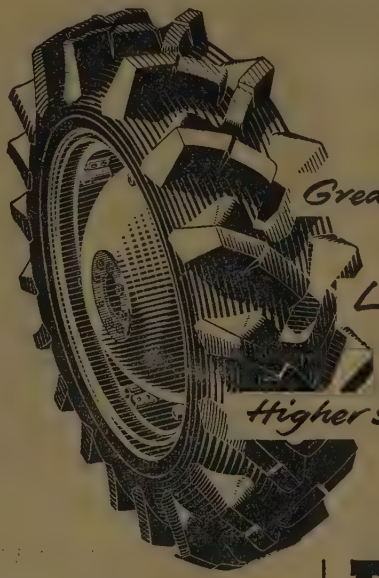

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dock. A feature of this system is that very little cleaning is required, but there are a number of disadvantages, which will be discussed later.

General-purpose layout: The idea behind the selection of the next layout was that much the same pattern as in the Waikato layout should be adopted but the stock would be largely confined to houses concentrated about a 4ft. wide central race. To preserve an extensive feature in this layout it was considered to have comparatively large pens or units of the type known as general-purpose houses. They are a type recommended for farm use today. These houses are about 13ft. 6in. square and have a creep area, side dung race, and a 10ft. trough parallel to the feed race. A drain 16in. wide runs along the rear of each house. The pigs are allowed controlled access to four paddocks. On the 10-sow farm three round farrowing houses were included on a floor area identical with the above units.

Considerable work is needed to clean out this layout properly and the initial cost is greater than that of the Waikato paddock layout.

Whey-feeding layout: For the study of a layout in which the central feed race pattern is still further condensed, smaller units of the type commonly used in Taranaki on farms feeding whey were chosen. These units have a frontage of only 8ft. and are 18ft. deep. The troughs serving two pens are placed against the dividing wall and at right angles to the feed race. Drainage is via two channels on either side of the central feed race.

One round farrowing house was included in the layout on the 5-sow farm and two round farrowing houses on the 10-sow farm. One would expect less work in feeding and cleaning to be required in this layout than in the general-purpose layout and the unit to be less costly. (Only the sleeping quarters were presumed to be enclosed.)

In these concentrated layouts with a central feed race there is the problem of orientation to take advantage of sun, but in well-insulated houses the pigs ought to be comfortable at all times and under good management there should be little to worry about. In exposed localities the whey-feeding layout offers possibilities for protection, because the roof on opposing units can be continued on over the feed race to enclose all of it, and the front wall to the sleeping quarters can be dispensed with.

Radial layout: The system of arranging pens or paddocks radially about a central feed point is by no means new to pig farming in New Zealand, but it has not been adopted very widely. It has its limitations, but faulty construction and management appear to be responsible for it not gaining in favour.

The plan adopted for this analysis is that used widely in Northland. Some modifications were necessary, but briefly the semi-circular layout of 6 pens was used for 5 sows and the circular layout of 11 pens for 10 sows—about the limit of its capacity. Round houses were placed around the perimeter of the concrete base, which has a radius of 28ft. Troughs lie along dividing walls and protrude into the central feeding area, which has a radius of about 8ft. Drainage is outward toward the perimeter and thence by a narrow bordering drain to the sump.

The obvious advantage of this layout is that all troughs are very close to the supply tank, which is in the centre of the layout.

Methods of Working Layouts

The analysis covered six methods of working the layouts on both the 5-sow and 10-sow farms and these will be discussed briefly.

(a) Buckets (4-gallon) were filled from a screw-type tap of a supply tank (200-gallon); yards were cleaned daily with a broom and low-pressure hose and cleaning varied according to the class of stock housed or the purpose of the floor being cleaned.

(b) Buckets were filled as in (a), but yards were cleaned on alternate days.

Pigs will always be fed, but there is a tendency to postpone cleaning of yards if other farm work must be done urgently. Cleaning at intervals of longer than every other day cannot be recommended, though cleaning on alternate days, if well done, should be quite satisfactory.

(c) Buckets were filled by dipping them into the supply tank; yards were cleaned daily. This method of filling buckets can be slightly quicker than filling via taps, but requires more effort and would appeal most when troughs are close to the supply tank.

(d) Buckets were filled by dipping them into the supply tank; yards were cleaned on alternate days.

(e) Milk was piped to troughs; yards were cleaned daily.

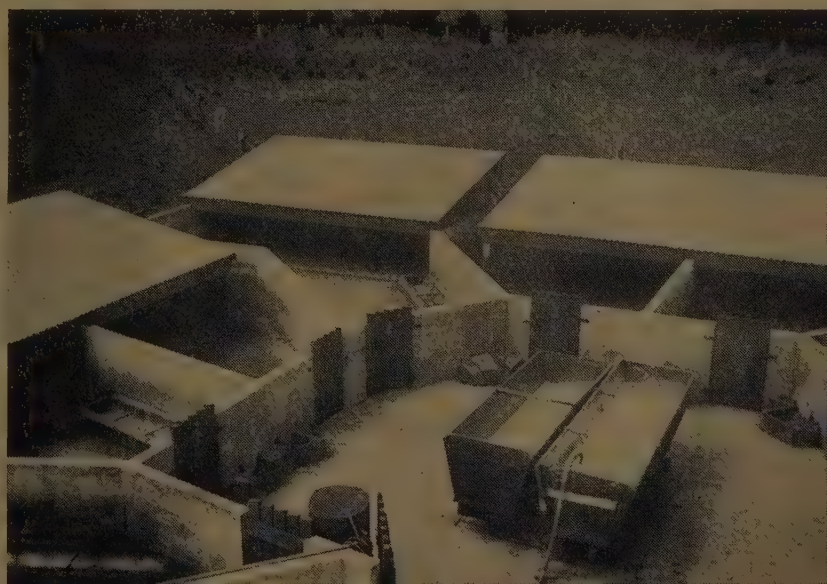
(f) Milk was piped to troughs; yards were cleaned on alternate days.

Whey is often piped to troughs, but few skimmed milk supply farms use this method. The chief obstacle is ensuring that the milk curds are sufficiently broken down to prevent blockages. Electrically operated agitators are ideal, but few farmers have electric power at their piggeries and in many cases the cost of installing it would be considered too high. Stirring by hand has little appeal and so farmers are prepared to carry on with bucket feeding.

However, the piping of milk does speed up the work and makes it easier. In this analysis the supply tank is assumed to be on the roof of a 7ft. high meal house and piping to be 1¼in. The higher the tank is, of course, the faster the flow of milk under gravity pressure will be. At the troughs a plug cock or a gate valve would give the best control over the milk.

Discussion of Results

Some measure of the over-all efficiency of the various layouts and methods of management over 1 year's operation was desirable and this was obtained in the following manner: Total times calculated for each combination were weighted for distance walked and, when valued at 5s. per hour, became the charge for labour. Overhead charges of interest and de-



A radial layout on a rectangular concrete floor. Feeding occupies little time with this layout. →

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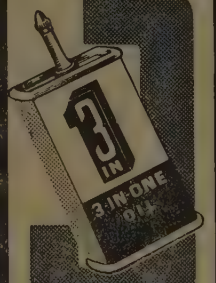

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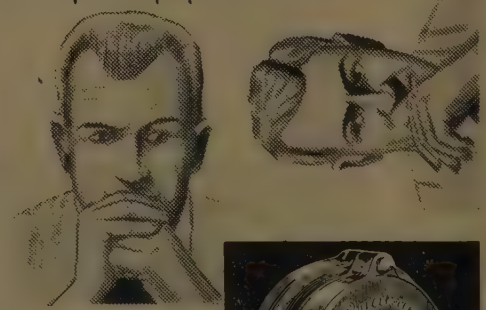

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preciation on capital invested in buildings, fences, and equipment were estimated for each layout. These charges included the cost of installing electric power and piping applicable to each layout.

In Table 1 labour and overhead charges are combined and thus form the index of efficiency for each layout and method of working.

A single-range layout → with comparatively large units. Skimmed milk is piped to the troughs and the storage tanks are stirred by hand.

Comments on Table 1

5-sow Farms

1. With any particular layout there is little difference in cost between bucketing and piping milk when cleaning is done daily.

2. Similarly there is little difference when cleaning is done on alternate days, though this method of cleaning reduces costs by about £7.

3. For any particular method of working there is a fairly consistent difference of about £7 between layouts in their order in Table 1.

4. The most efficient combination of layout and method of working is the radial layout cleaned on alternate days and with milk piped to the troughs.

This combination is about £30 cheaper than the least efficient one, the general-purpose layout cleaned daily and where buckets are used in feeding milk to pigs.

10-sow Farms

1. With an increase in herd to 10 sows the advantages of having a concentrated layout rather than an extensive type become more apparent, and methods of working assume some importance. Thus the radial and whey-feeding layouts tend to produce similar results which are some £30 to £40 cheaper than the Waikato paddock or general-purpose layouts. As layouts increase in size, therefore, the whey-feeding layout becomes relatively more efficient and the Waikato paddock type relatively less efficient.

This analysis shows again that the best combination is the radial layout cleaned on alternate days and equipped with pipes and the worst combination is the general-purpose layout cleaned daily and equipped with buckets (a difference of nearly £70). However, it appears that if herd size is increased further, the whey-feeding layout soon becomes the best type and the Waikato paddock layout the worst.

2. The saving due to the piping of milk rather than bucketing was least with the radial and Waikato paddock layouts. Where the troughs are so near at hand, as in the radial type, bucketing is quite efficient. In the Waikato paddock layout any saving in time is largely countered by piping costs.

3. A greater saving, consistently about £18, is achieved by cleaning on alternate days instead of daily. In practice if this interval between cleaning were extended unduly, it could easily result in sickness, poor growth or death of pigs, and loss of enthusiasm and money on the part of the farmer.

TABLE 1—EFFICIENCY INDEX OF THE COST OF 1 YEAR'S OPERATIONS FOR VARIOUS PIGGERY LAYOUTS AND METHODS OF MANAGEMENT

No. of sows	Layout	Method of management			
		Milk bucketed from tap or tank		Milk piped to troughs	
		Yards cleaned daily	Yards cleaned alternate days	Yards cleaned daily	Yards cleaned alternate days
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
5	Radial	110 0 0	101 10 0	108 0 0	99 0 0
	Whey feeding	116 15 0	109 0 0	114 10 0	107 0 0
	Waikato paddock ..	125 0 0	*	123 5 0	*
	General purpose ..	131 0 0	122 0 0	129 10 0	123 5 0
10	Radial	219 0 0	197 15 0	212 15 0	191 10 0
	Whey feeding	224 5 0	206 15 0	211 10 0	196 10 0
	Waikato paddock ..	258 0 0	*	253 15 0	*
	General purpose ..	259 0 0	241 0 0	241 10 0	223 5 0

* Not considered because of the small amount of cleaning required.

Relating Calculated Results to Practice

A preliminary analysis of the time only required to operate these layouts showed that management was more important than type of layout. Table 1 suggests that the reverse is true. Therefore, because a certain layout requires less time to work it than another, it is not necessarily more economic. However, the selection of the most suitable layout to construct may be decided by other factors such as site, soil conditions, and climate.

Management must then become important and improvement can be effected by cleaning out less frequently or by piping liquids direct to troughs. Unfortunately the practice of cleaning out less frequently is common and when taken too far leads to general neglect. The 1951-52 pig production survey yielded some informa-

tion on the proportion of the total management time required for cleaning and feeding. No details of layout were obtained, but on 20 farms cleaning occupied 18 per cent. of the total time and feeding 65 per cent. In the present analysis when cleaning was done daily it took from 47 to 58 per cent. of the time and feeding 18 to 26 per cent. on 10-sow farms other than those with the Waikato paddock layout. When cleaning was done every other day the time spent on cleaning was reduced by 16 per cent. and on feeding increased by 7 per cent.

It is not likely that the 20 farms in the 1951-52 survey included many with Waikato paddock layouts, but probably the pigs were allowed continual access to runs. In the latest analysis cleaning of the Waikato paddock layout occupied only about 4 per cent. of the total time.

If the index of efficiencies given in Table 1 is to be accepted as a fair measure of the values of the four layouts described earlier, it must permit a reasonably accurate assessment of results on farms. Therefore, a number of farms have been chosen and classified according to their piggery layout for comparison with the calculated results for the time required to produce 1000lb. of pig meat. On some farms the results for 2 years' operations are available. This comparison is shown in Table 2 with details of labour reward and pig meat produced per 100lb. of butterfat as a reflection on the quality of management.

From Table 2 it is obvious that of the first four layouts only the radial does not show good agreement between the calculated and on-farm labour requirements. Two reasons are suggested for this discrepancy. First, cleaning was less frequent and thorough on the farm. At this piggery a number of pens of pigs were allowed continual access to the runouts provided. Such a practice does not really reduce the need for cleaning, because eventually the ground surrounding the piggery for some 10yds. out becomes churned up into a filthy mess which finds its way into the pens and assists in the spread of disease; the controlled use of runouts will always pay. The second reason is that only a very small amount of supplements was fed.

The two types of single-range, general-purpose layouts have been included, though no calculations have been done for them. They illustrate the possibilities in piping milk to troughs and in level of production for other layouts when management is efficient.

TABLE 2—COMPARISON OF THE CALCULATED LABOUR REQUIREMENT WITH THAT REQUIRED ON FARMS GROUPED ACCORDING TO LAYOUT, AND OF THE STANDARD OF PRODUCTION ON THOSE FARMS

Type of layout	Number		Hours/1000lb. pig meat		Net return for labour per hour after deducting food costs	Pig meat per 100lb. butterfat
	Farms	Results	Calculated	On farm		
					£ s. d.	lb.
Radial	1	2	28	17	3 7 9	40
Whey feeding (whey piped)	2	3	36	39	1 9 11	24*
Waikato paddock ..	1	1	35	36	1 5 10	55
General purpose ..	4	6	50	48	1 4 11	62
General purpose (single range; milk piped)	1	1	33†	13‡	3 11 2	55
General purpose (single range; 5 sows) ..	3	5	33†	44	2 0 0	50

* On whey, † for double range, ‡ pigs are fed twice daily on this farm.

The first four layouts are arranged in descending order of over-all efficiency, and the net return for labour diminishes likewise, though production of pig meat per 100lb. of butterfat tends to increase with the less-efficient layouts. Admittedly only a small sample of farms has been considered, but this situation does indicate the great importance of management in moulding the resources of stock, food, and equipment into a really successful enterprise.

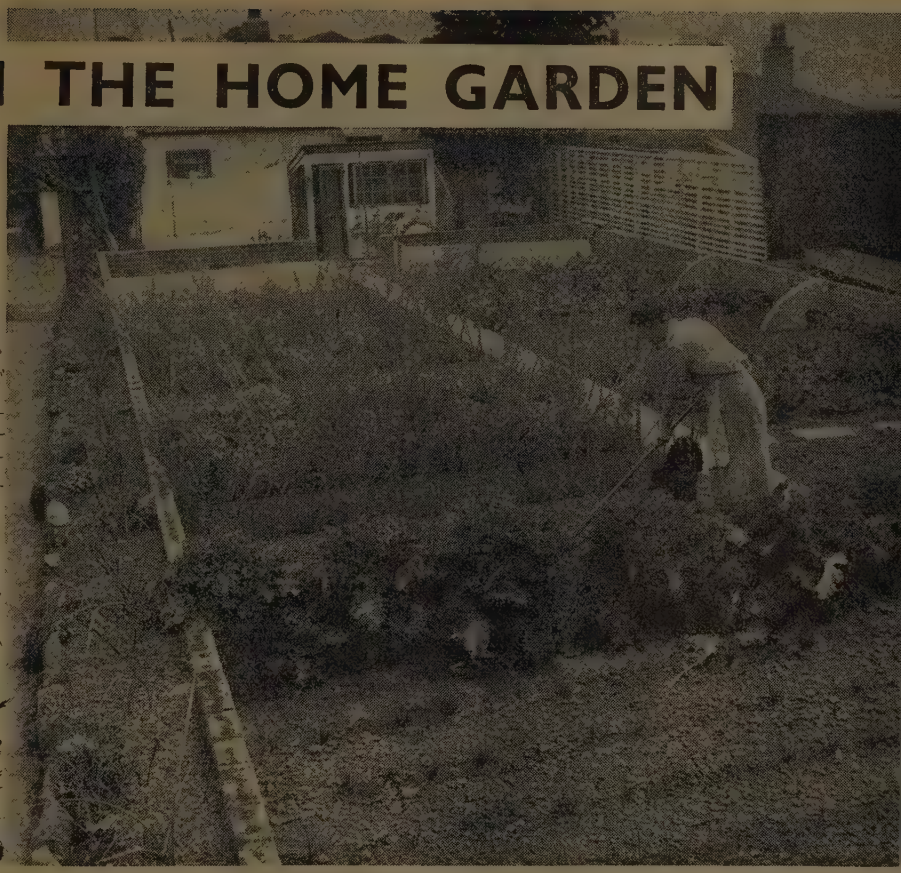
It is one thing to advocate better management and another to put it into practice on the farm, a simple reason being time. Many farmers are interested in pigs even in these days when butterfat cheques are good. They can see what needs to be done to keep the piggery in good order and the stock in good health and they are quite capable of doing it, but they have not got sufficient time; something unexpected happens or other work must get priority over that required at the piggery. The production of 40lb. of pig meat for every 100lb. of butterfat ought to be well within the scope of the average farmer. To improve on this needs a little more skill and organisation. Labour-saving methods which can reduce the time at the piggery by as little as ½ hour daily must appeal to all pig producers.

Though all pig producers would derive benefit from using the most efficient layout, the success of any enterprise depends primarily on the quality of management. Some evidence collected showed that excellent results were achieved by farmers whose layouts were not very efficient. As pigs respond quickly to good treatment, the farmer who can should provide this by selecting the best available site for the piggery and choosing a layout which will enable him to give the attention required in the most convenient and economical manner.

Meteorological Records for February

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	68.0	+ 2.4	82.2	48.0	8.53	17	+ 4.36	1.98	6	137
Auckland	160	70.2	+ 3.5	80.9	54.8	1.73	7	— 2.18	1.20	5	205
Tauranga	10	67.6	+ 2.6	80.7	51.0	2.95	9	— 0.78	1.30	5	210
Ruakura	131	66.8	+ 3.5	83.4	43.8	0.91	7	— 2.17	0.39	5	190
Rotorua	975	65.6	+ 2.7	81.5	44.7	2.84	7	— 0.91	1.14	5	187
Gisborne	12	66.8	+ 1.7	85.5	48.0	1.87	10	— 1.18	0.55	5	205
New Plymouth ..	160	67.2	+ 4.7	82.8	49.8	2.52	7	— 1.46	0.98	26	210
Kariol	2125	62.0	+ 4.4	80.4	35.4	1.69	6	— 2.36	0.80	3	
Napier	5	68.9	+ 3.5	89.0	49.9	0.11	4	— 2.57	0.05	19	212
Wanganui	72	66.6	+ 2.9	82.9	46.7	1.71	4	— 1.26	0.73	3	235
Palmerston North ..	110	66.4	+ 3.9	86.8	42.6	1.91	7	— 1.18	0.81	26	219
Waingawa	340	65.5	+ 3.1	88.5	40.3	0.91	7	— 1.90	0.37	26	216
Wellington	415	64.4	+ 3.1	85.2	46.6	3.56	7	+ 0.28	1.74	3	226
Nelson airfield ..	5	64.2	+ 3.0	81.9	41.3	1.95	5	— 0.67	1.40	3	247
Blenheim	12	66.0	+ 3.2	89.0	43.0	1.92	4	— 0.22	0.81	3	250
Hokitika	15	60.0	+ 1.9	76.9	42.4	4.27	11	— 3.46	1.87	25	205
Hanmer	1270	62.2	+ 2.8	87.0	32.0	1.91	6	— 1.74	1.14	19	200
Christchurch ..	22	64.9	+ 4.1	90.2	40.7	0.54	8	— 1.26	0.18	25	215
Ashburton	323	65.7	+ 4.7	92.0	40.0	2.19	10	— 0.50	0.74	26	206
Timaru	56	62.9	+ 2.7	88.5	42.8	1.95	12	— 0.27	0.62	26	194
Alexandra	520	64.9	+ 3.5	87.5	37.8	1.79	6	+ 0.32	0 87	12	225
Taieri	80	59.6	+ 1.9	86.4	36.4	2.20	8	— 0.11	0.81	25	188
Invercargill airfield ..	0	57.6	+ 1.4	80.4	37.1	2.01	14	— 1.34	0.69	21	169
Chatham Islands ..	140	61.7	+ 3.3	74.9	45.8	3.61	13	+ 1.22	1.15	22	

WORK IN THE HOME GARDEN IN MAY



MAY is not one of the most interesting months in the vegetable garden and untidy or poorly managed gardens usually look their worst then. Little sowing or planting is advisable in most gardens and usually work for the month is made up of such jobs as tidying and other maintenance work, construction or modification of garden features, sowing green crops, burning matter that is unsuitable for composting, liming, and digging over vacant ground. In this article A. G. Kennelly, Horticultural Instructor, Department of Agriculture, Dunedin, discusses work in the vegetable garden in May.

SOME planting and usually some sowing have to be done in May, but the soil should be well drained and cultivated. If firming is necessary in the preparation of the seed-bed, it should be confined to the seed or plant rows and done only in moderation on medium and heavy soils. A simple and usually effective method of testing soil condition for sowing is to walk on it. If it sticks to the soles of the boots, it is too wet.

Comparatively little growth can be expected in most gardens in the next 2 months and the home gardener must decide whether anything is to be gained by sowing or planting any but the hardiest subjects. It is not usually advisable to plant or sow even hardy subjects in cold situations where the aspect is unfavourable and where the soil is heavy and poorly drained. Temperature and other aspects of the weather in winter are not usually so favourable that the plants should be subjected to the additional hazard of a cold, wet soil if this can be avoided.

Cabbage, silver beet, and spinach can still be set out in most gardens and, where conditions are not likely to be too severe, lettuce and cauliflower as well. Broad beans and spinach can be sown in most gardens and in some districts peas, but unless the garden is in a favourable situation and the weather likely to be good, it is best to defer sowing seeds of such subjects as carrots, onions, turnips, and even radish until July or later. The top growth of asparagus should be cut down as soon as it begins to turn yellow and the digging of kumaras and, in most situations, potatoes should be completed without delay. Potatoes and other root crops in store should be sorted over to remove those with rots.

Vacant ground can be sown with a green crop (oats or barley are suitable at this time of year) or limed and attention given to the compost heap and to the burning of rubbish. Rhubarb beds should be weeded and the seed stalks removed.

If the garden is tidy, it can be quite an attractive place in winter even to those who are not gardeners. The cleaning out of untidy corners and the removal of such trash as old boxes and pieces of wood, stakes, bricks, and stones not only improve the appearance of a garden, but have an important bearing on pest and disease control. Untidy corners provide ideal breeding grounds for such garden pests as earwigs, cutworms, millepedes, slaters, snails, slugs, and wireworms.

Weeds, whether among crops or elsewhere, should be destroyed, as they often serve as a means by which pests such as thrips, mites, and aphids which are often considered more serious than weeds are carried over from season to season. Weeds also serve as host plants for some virus and fungous

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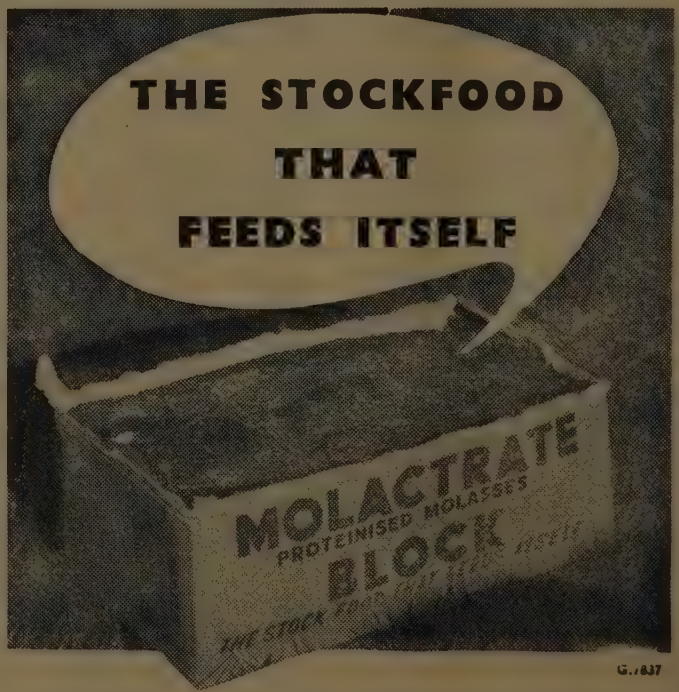

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diseases from which insects infect the succeeding crops. All weeds, long matted grass, and untidy corners should therefore be cleared away.

Soft rubbish can be composted and unwanted woody material should be burnt. Refuse of some diseased crops can safely be composted, but if there is any doubt about the longevity or resistance of the disease to such destructive agencies as occur in compost heaps, the refuse should be burnt, as should most garden refuse that is infested with active insect pests.

The Garden Bonfire

Most home gardeners know that wood ashes of the garden bonfire usually contain potash, which is a useful fertiliser in the garden, but the idea commonly held that the burning of rubbish that could be composted is a method of gaining something new is wrong. Burning is wasteful and what happens is that the useful organic or non-mineral matter is lost into the air in the form of a gas and only the mineral substance is left.

Wood ashes and the ashes of garden weeds are valued chiefly for their potash and lime content, though they generally contain trace amounts of many other minerals.

The potash content of garden ashes is mainly in the form of carbonate of potash and may range from about 1 per cent. to about 12 per cent. Lime content is also usually fairly high, and garden ashes should not therefore be applied to land on which it is, for instance, intended to plant potatoes. However, the ashes of the garden fire, whether used at once or stored under cover until required, usually make a good fertiliser for most crops, but the loss of the valuable organic matter in burning, which includes nitrogen (the dry matter of plants may be composed of up to 5 per cent. of nitrogenous matter), is serious if the fire includes material that could be composted.

However, old, useless wood or woody material, particularly if infested with pests or diseases, should be burnt. Because so many home gardeners find it difficult, either because of lack of skill or because of an insufficiency of material which breaks down easily, to build a compost heap in which the temperature quickly rises high enough to ensure the rapid breaking down of all combustible material added to the heap, it is usually best to burn all material which harbours certain pests and diseases and also to burn the roots of any perennial weeds.

Slow burning as the result of restriction in the amount of air or oxygen present gives a product which contains more carbon or charcoal (a valuable constituent of garden ash) than does burning in an open fire, and in a properly built, slow-burning fire there is an almost entire absence of smoke. For these reasons it is well worth while where suitable materials are available for burning to build a slow-burning or smother fire. It should be built according to certain established principles, being banked with soil and having only a small air vent which will admit only enough air to enable combustion to proceed very slowly. A well-constructed heap may burn steadily for days or even weeks.

Broad beans usually do well from a May sowing.

The value of charcoal in the garden has long been appreciated. Charcoal is a form of carbon with the power of absorbing gases and is sometimes used in purifying water and other substances. In soil it decays and produces humus, which also has some of the power of charcoal to absorb gases and soluble substances. Fine particles of charcoal in the ashes of the garden bonfire therefore make the ash of special value when applied to the soil, because of that ability to absorb soluble plant foods which might otherwise be leached out of the soil and to hold them until they are absorbed by plants.

Ash of young wood, twigs, and similar growth and of material such as bracken is richest in potash. The different kinds of mature wood are extremely variable in the potash content of their ashes. Some are nearly 10 times richer than others. Most weeds are quite low in potash. Whatever its source, the ash from the garden fire must not be exposed to rain or its most valuable constituents will be lost quickly.

Ashes are beneficial as fertilisers on nearly all soils, but must be applied with discretion, especially to heavy soils. Heavy dressings are liable to cake the surface of the soil and impair the tilth and therefore they should be avoided on heavy soils unless incorporated deeply and thoroughly.

Broad Beans

May is usually the preferred month for sowing broad beans, as they are very hardy and do well in cool conditions. As broad beans are easy to grow and most varieties can be relied on to produce a good crop with very little attention, they deserve a place in the garden of every home where their flavour is appreciated. The earlier sowings usually mature at a time when vegetables are scarce and lacking in variety in most gardens.

They do not require special soil, but it is not advisable to sow them in wet, sticky soil or light soil that tends to dry out. They do well in fairly heavy, moist, well-drained soils that have been thoroughly cultivated and into which has been worked, if the soil lacks organic matter, a moderate amount of material such as compost or well-rotted farmyard manure.

The principal plant nutrient required on most soils is phosphoric acid, which can be supplied by superphosphate or by bone manure, though on soils such as those in many home gardens that have been cultivated for many years

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without a balanced manurial programme being followed, a complete fertiliser containing nitrogen, phosphorus, and potash is likely to give best results. Apart from their nutrient value phosphates are said to have a stimulating effect on the bacteria on the nodules of the roots of broad beans which help to keep the plants supplied with nitrogen.

Broad beans require only a small amount of nitrogen. A mixture of 1 part of sulphate of ammonia, 4 parts of superphosphate, and 1 part of sulphate or muriate of potash, all by weight, or alternatively 3 parts of blood and bone, 2 parts of superphosphate, and 1 part of sulphate or muriate of potash, worked in at 2oz. to 3oz. to the square yard according to the fertility of the soil, is likely to give good results on most soils that have been well dressed with balanced fertilisers for previous crops.

Though broad beans are tolerant of a fairly wide range of acidity or alkalinity, they will not thrive in excessively acid conditions. In districts with moderate or heavy rainfall growth in most soils not recently limed will be improved by applying carbonate of lime at about 2oz. to 4oz. to the square yard. It is best worked in some time before sowing.

Apart from weed control, beans should require little attention when young, but it is usually advisable in winter or early spring when the weather is boisterous to draw a little soil against the stems of autumn-sown plants to support them. Tall varieties can be stopped when they are about 30in. to 36in. high by pinching out the tops. This encourages the plants to develop sturdy growth and is often sufficient to check an attack of black aphids in its early stages, particularly if the aphids' natural enemies, such as lacewing flies, ladybirds, and their larvae, are numerous.

In many gardens where tall varieties are grown it is advisable to support the plants as they develop or as they become heavy with pods. One or more strings run along the sides of rows and tied to stakes at intervals of 5ft. to 6ft. will save the plants from being blown over.

Sowing

Beans sown early in autumn do not necessarily yield pods earlier than those sown in late autumn or early winter, because though the plants may make good growth in late autumn and early winter, they are likely, particularly where winters are fairly severe, to be damaged and checked by disease or by boisterous weather. The earliest flowers often fail to set because they are produced at a time of unfavourable soil conditions and sudden extreme temperature changes, but spring sowing should not be delayed too long, as the crop is liable to be reduced if it matures in the hot, dry conditions of summer.

Wire-netting guards are most useful on plants such as peas and lettuce when food for birds is scarce.

In deep, well-drained soil broad beans are best set 2in. to 3in. deep, preferably with a trowel, and 4in. to 6in. apart. They may also be sown in the bottom of a drill about 3in. deep. Seed can be planted in double rows 10in. to 12in. apart, with each double row not less than 26in. apart. If single rows are preferred, they should be 15in. to 18in. apart. Germination is usually good, but a few extra seeds can be sown at the ends of rows and seedlings later transplanted to fill gaps; young plants should be transplanted as early as possible.

Seed varies in size, but a little less than a quart of seed will sow about 50ft. of double row. Germination can usually be speeded by soaking the seed for about 12 hours before sowing. Seed dusts give some protection to newly sown seed against soil-borne disease.

Varieties

Two main varieties of broad beans are grown in New Zealand, the broad-podded or Windsor type and the long-podded type. The broad-podded type has relatively short, broad pods usually containing about 3 to 5 large seeds. It is represented by varieties such as Broad Windsor, Giant Windsor, and Harlington Windsor. Early Long Pod and Mammoth Pod are examples of the long-podded type, varieties of which may produce pods up to 16in. long, though usually they are about 5in. to 9in. long and contain about 4 to 7 seeds. The Windsor type is usually considered to be of superior flavour, but the long-podded beans are hardier and yield more heavily.

Dwarf varieties of broad beans are also sold by some seedsmen. They are well worth growing in small gardens or in exposed situations and they are also useful for sowing in January where conditions are not too hot and dry (or even in February where the growing period is long enough) to mature before winter. The pods contain 2 to about 4 small seeds and are usually attached in fan form. The foliage is small and often fairly dark. Examples of the type are Coles Early Dwarf and Dwarf Gem.

Potatoes

Potato crops should be mature by the beginning of May, and digging should not be deferred longer than necessary, as the tubers, particularly in wet or poorly drained soils, are liable to injury by pests and diseases. Potatoes should be clean and free from injury and disease before they are put in storage. They store well in bags, bins, or boxes in cool conditions where there is some, but not excessive, moisture. Air circulation should be good.

Peas

Though garden peas are hardy and yields are usually higher and the quality better when the crop matures under comparatively cool conditions, heavy frost is liable to affect the setting of the flowers, and frost after a mild period during which soft growth has developed may damage the haulms. In districts where winter conditions are severe autumn sowing should be made sufficiently early to enable the young plants to become established but not so early that they

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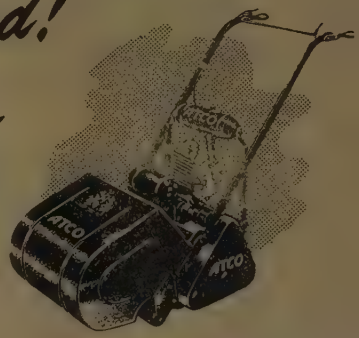

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make soft growth. Losses from autumn sowing may be serious in severe weather, but in well-drained soils in districts where winters are not hard autumn sowing is usually satisfactory.

In many districts, however, autumn-sown crops mature little ahead of crops sown in favourable conditions in spring. For autumn and spring sowings seed should be dressed with a suitable seed protectant, such as captan, chloranil, or thiram. The peas should be shaken for several minutes in a tin containing enough of the chemical to coat the seed. Afterward excess should be removed by tapping the tin sharply so that the powder falls to the bottom.

Pea seeds germinate and the plants make vigorous growth at temperatures considerably lower than those suitable for many other vegetables.

Sowing

Seed should be sown 1in. to 2in. apart in V-shaped or broad, flat drills, which can be drawn out with the hoe 18in. to 36in. apart according to variety. Drills should be 2in. to 3in. deep, except where conditions are hot and dry, when they should be considerably deeper so that, though the seed should not be covered with more than 1½in. to 2in. of soil, the roots will be well down in the cooler and moister levels.

The seed-bed should be thoroughly cultivated, as a fine, well-prepared seed-bed has an important influence on the promotion of even, full germination and uniform maturity at harvest.

Protection of newly emerged peas against birds is essential in some districts, though birds are troublesome mainly in early spring, when food is short. Pea guards made of wire netting are effective if the ends are blocked, but they should be moved before the peas become entangled in the wire. Cotton stretched over the shoots is also effective if a number of strands, which may be criss-crossed or placed in parallel lines, are used.

Manuring

Peas, though they add some nitrogen to the soil and improve the physical nature of most soils, are an exhausting crop because they have high demands for plant foods. For this reason and because the period between sowing and harvesting of most varieties is comparatively short, the soil should be well cultivated to enable the roots to spread freely and gather rapidly the nutrients needed by the plants.

Crop failures are often due to poor drainage and sometimes to inadequate liming, though liming should not be too heavy, as a neutral or slightly acid soil suits most pea crops. An annual dressing of 3oz. to 4oz. of lime per square yard is usually satisfactory, though heavier dressings may be needed in high-rainfall districts.

On soils of fairly high fertility, such as virgin soils or those that have been heavily dressed with organic manure for a previous crop, fertiliser applications need not be heavy. A dressing of superphosphate applied at about 1oz. to 2oz. per square yard may be sufficient, but on most well-worked garden soils a complete fertiliser (such as a mixture containing by weight 2 parts of sulphate of ammonia, 6 parts of superphosphate, and 1 part of sulphate or muriate of potash) at 1oz. to 2oz. per square yard gives good results. Peas are highly sensitive to fertiliser injury and care should be taken that the manure does not come in contact with the seed.

Solid, permanent paths are a boon in winter.

Varieties

Popular varieties of peas for autumn sowing for early spring cropping include William Massey and Little Marvel.

Spring Cabbage and Cauliflower

Spring cabbage and cauliflower can be set out as advised in last month's "Journal", if this work has not yet been done. Sturdy, well-grown plants with good root systems should be set out in well-prepared soil.

Spinach

Spinach is a useful vegetable for late-autumn sowing and is quick growing, maturing under favourable conditions in from about 40 to 55 days. Because it is hardy when established under cool conditions, it can be sown throughout winter in well-drained and well-cultivated soil that is not too heavy, provided the seedlings can establish themselves without being lifted by frost.

Spinach will grow at temperatures only slightly above freezing, though the most suitable temperature is somewhat higher. Though seed germinates at relatively low temperatures (40 degrees F. or even lower), seedling emergence is usually delayed where there is frequent heavy rain. Germination is good at 50 to 60 degrees F., but the percentage decreases at higher temperatures.

Types

Spinach can be classified in several ways according to whether the seed is round or prickly, the leaves of the

plant are smooth or savoyed (crumpled), or the varieties are long standing or go to seed quickly. Most New Zealand seedsmen still class spinach mainly as either prickly (seeded) or round (seeded), though because of the many very fine varieties produced by overseas plant breeders for specific purposes, more frequent listing of named varieties suited to specific purposes is desirable.

Prickly seeded spinach is usually sold for winter use, as it is generally considered to be hardier than the round seeded. Because it is considered by many to be longer standing, it is also very popular for summer use. This belief in the superiority of prickly seeded spinach is not supported by the evidence of trials of different varieties of the two kinds, as it has now been clearly demonstrated that there are long- and short-standing varieties of both round and prickly seeded spinach; either may have smooth or crumpled leaves.

The habit of bolting to seed, which is an inherent factor present to a greater or less degree in all varieties, is encouraged by long days and high temperatures. For this reason summer sowing of even the relatively long-standing varieties is not advisable in certain districts; even the most suitable varieties will not germinate and grow well in hot, dry weather. When excessively high temperatures are maintained for some time the edges of the leaves, particularly of the older ones, turn yellow. Continued high temperatures usually result in the whole leaf turning yellow and the plant is then likely to die of root or collar disease.

Soil and Fertiliser

Spinach thrives in cool conditions on a great range of moist, fertile, well-cultivated, and well-drained soils. It will not tolerate a very acid soil, and lime should be applied to most soils that have not been dressed recently, though too much lime may cause yellowing of the leaves because of a deficiency or unbalance of certain essential elements such as manganese or iron.

A good dressing of organic material such as well-rotted farmyard manure or compost supplemented by a complete fertiliser with a ratio of about 1:3:1 or 2:3:1 of nitrogen, phosphoric acid, and potash applied at the rate of 1½oz. to 3oz. a square yard is advisable on most garden soils. As spinach is a leafy vegetable, extra applications of nitrogen may be supplied, particularly when temperatures are favourable for good growth, by liquid manure or a side dressing of nitrate of soda or sulphate of ammonia raked in along the line of row, but it should not touch the foliage. Liquid manure is preferable where conditions are inclined to be dry, as abundant moisture is essential for high yields and good quality; growth should be reasonably quick, as otherwise some varieties tend to be tough.

Sowing of Seed

Seed should be sown thinly ½in. to 1in. deep in rows 12in. apart. Plants can be thinned to 4 or 5 to 1ft. of row, though if sown thinly, thinning in the accepted sense is not essential unless conditions are dry or the soil is very poor; it can be confined to the removal of the young plants when large enough for use. In poor soil or in dry conditions crops that have been given generous spacing in the seedling stage usually stand much longer.

Virus Disease

A number of distinct viruses cause mosaic symptoms in spinach. Cucumber mosaic has occurred on spinach in New Zealand. The first symptoms appear on the youngest leaves as numerous, fairly large, golden yellow flecks, accompanied by crinkling. In a few days yellowing becomes general over the leaf. Older leaves wither at the tips, become yellow, and die. In a few weeks the plant is reduced to a small, stunted rosette of crinkled leaves. Infected plants should be destroyed.

Aphids are probably the most active agents in spreading mosaic, which may be carried over from one season to the next in plants of crops such as silver beet, spinach, and beetroot. Aphids should be controlled by regular sprays with lindane, nicotine sulphate, or HETP.

Standing Crops

Spring and savoy cabbages and cauliflowers should be kept weed free and the soil between the rows as loose and free as the spacing of the plants allows. In districts where humidity is high, mildew is often troublesome and young cabbage plants should be sprayed with bordeaux or a suitable Government-certified substitute.

Unless the soil is rich, most brassica crops will benefit, particularly when the temperatures are high enough for good growth, from regular application of organic liquid manure or of liquid manure made by dissolving about 1oz. of nitrate of soda or sulphate of ammonia in 2 gallons of water.

Both cabbage and cauliflower should be kept growing vigorously without check. Poor soils produce poor cabbage and, combined with other adverse conditions such as low temperatures or root damage, may cause cauliflowers to form only miniature heads.

Where row spacing permits soil can be banked along the row against the stems of brussels sprouts or late-maturing broccoli to help stabilise them.

Autumn-sown onion seedlings should be kept weed free, as they suffer even more than most crops from competition from weeds. Poorly developed plants usually benefit in poor soil if given liquid manure.

Though leeks will usually stand more ill treatment than almost any other vegetables, they respond specially well to good growing conditions, particularly good cultivation and manuring. An increased length of white stem can be obtained by earthing up the stems as the plants develop.

Lettuce should be kept cultivated and the plants should be well spaced, as aeration and drainage are important in disease control.

Tomatoes

Any remaining tomato plants should now be pulled up and can usually be put on the compost heap. They should be chopped up first, but where stem borer caterpillars have been troublesome and the chrysalises of the looper caterpillar are present the stems are best burnt. If suitable material is available for making a very efficient compost heap, where the heat rises rapidly and remains for a time at a high enough temperature to kill the pests, tomato plants can be composted.

Only very short storage of nearly mature tomato fruits is possible in the home garden. Nearly mature, well-coloured fruit can be ripened successfully if subjected to fairly warm conditions where there is sufficient moisture to prevent flesh collapse and where strict hygiene is practised.

Slugs and Snails

The dampness of the ground usual in late autumn and winter suits creatures such as slugs and snails, which may be very damaging to cabbages, cauliflowers, lettuces, and seedlings. There are several species of slugs and snails, though slugs are more common than snails and are present in practically all home gardens.

Slugs and snails feed at night or early in the morning. Moisture is necessary for them and they shun sunlight and dry air. They shelter during the day in any place that is cool, dark, and moist. Their nocturnal habits and their habit of excreting a slime which assists them in crawling and also enables them to get rid of any irritating substance with which they may come in contact make them very difficult to control.

Species differ somewhat in their eating habits. Some feed mainly on the stems and leaves well above the ground and others feed chiefly at ground level or tunnel into the bases of plants, roots, or tubers well below ground level. They are voracious and have biting mouth parts with which they eat holes in plant tissue or eat the edges of it. The eggs of most species are easily recognised, being rounded, jelly like, and translucent. Control measures were discussed in the garden notes for March.

▲ The better establishment of ryegrass obtained by sowing the seed in 7in. drills (right) than by broadcasting.

Italian Ryegrass and Short-rotation Ryegrass

By R. G. JOLLY,
Fields Instructor, Department of Agriculture, Christchurch

AS pasture plants in New Zealand Italian ryegrass (*Lolium multiflorum*) and short-rotation ryegrass (*Lolium perenne* x *L. multiflorum*) are important mainly in localities where short-rotation farming is practised. They are grown chiefly to provide autumn, winter, and early spring feed, but are also used to some extent in mixtures for semi-permanent pasture or for hay crops.

ITALIAN ryegrass is a stronger-growing plant than perennial ryegrass, but is not so persistent. It is much broader in the leaf and is pale green compared with the dark green of perennial ryegrass. It is similar in vegetative character except that the leaf shoot is rolled and not folded as in perennial ryegrass. These grasses may be easily distinguished by their flower heads, as the lemma or outer portion of the seed of Italian ryegrass is strongly awned and that of perennial ryegrass has no awn.

The recently introduced strain of short-rotation ryegrass has most of the characteristics of Italian ryegrass, and differentiation between them is practically impossible even when they are growing side by side. Short-rotation ryegrass is more persistent, but apart from that it is very similar to Italian ryegrass in its vegetative habits, and management and utilisation of the crop for seed production are practically identical.

The growing of greenfeed has always been important in mixed farming rotations. In addition to providing supplementary feed, it fits well into the cultivation programme of a paddock. Because of its quick recovery after grazing Italian ryegrass has largely replaced cereals as a green fodder crop. It provides large quantities of highly nutritious feed, keeps growing during winter, and does not suffer from frost burn to any extent. It does not deteriorate in spring as do cereals, and therefore provides good feed throughout the lambing period. Once the permanent pastures have reached full production the Italian ryegrass stand may be closed, usually in September or October, and a seed crop taken in late December or January.

The growing of short-rotation ryegrass for seed is confined almost entirely to the South Island. The crosses indicate the principal seed-producing areas.

Place in Agriculture

Italian ryegrass is short lived, reaching its fullest production in the first year. Many of the plants die out at the end of this period, so it is often sown in association with the slower-establishing clovers in seed-producing areas.

Because it is the most useful and the highest producing of New Zealand's short-lived grasses, Italian ryegrass readily finds a place as a major constituent of seed mixtures for temporary pastures. In association with red clover or white clover it gives a high-producing pasture in its first year. The usual practice is to sow it in February or March with red or white clover; this will produce feed in April, May, and later months. An Italian ryegrass seed crop is then taken, a temporary pasture being left from which a clover crop is harvested in the second year. A second and even a third crop of clover are sometimes taken, and then the pasture is usually ploughed up.

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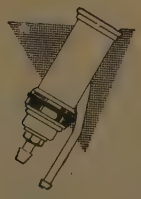

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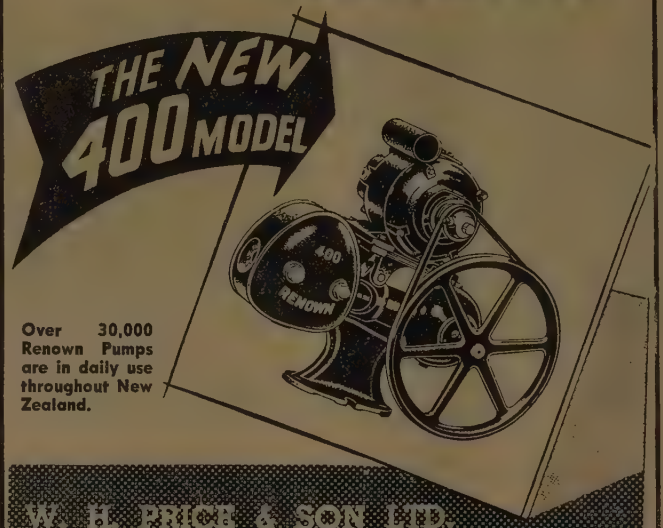

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Though the principal use of this grass is as an ingredient of temporary pasture mixtures, it may be included in a permanent pasture mixture. A small quantity will give an early bite of feed before the other grasses start to make growth. Care should be taken that only a small amount is included and that the pasture is grazed sufficiently early to prevent smothering of the more slowly establishing grasses and clovers.

Where it is intended to save seed from an area the ryegrass species should not be mixed, as the harvesting of them together was the direct cause of many inferior lines of ryegrass previously on the market.

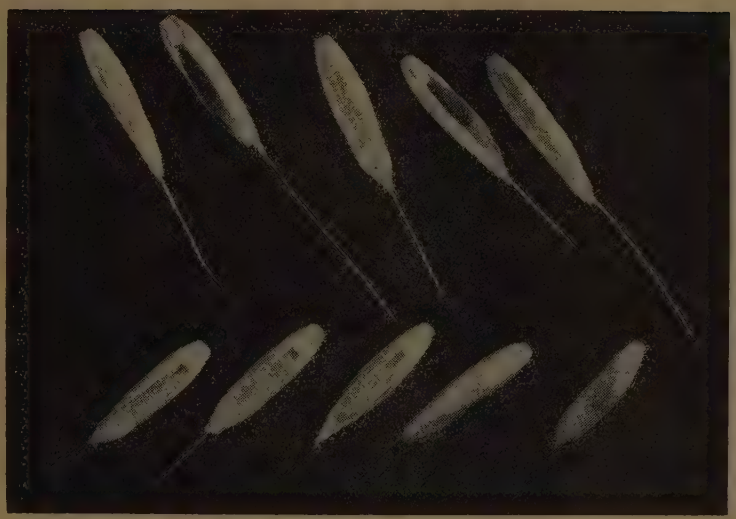
As a greenfeed crop Italian ryegrass sown pure fits in admirably with the cultivation programme of a paddock, especially where the aim is twitch control. When sown down after repeated cultivation during a summer fallow ryegrass makes rapid growth and acts as a smother crop. In spring the area may be ploughed and fallowing continued if required or the land sown to a fodder crop.

A common practice when turnips are being sown is to sow a light seeding of Italian ryegrass with them to provide a bite of greenfeed when the turnips are fed off.

The utilisation of short-rotation ryegrass follows along similar lines, except that it is intended for pastures of a more permanent nature. It is often included in mixtures intended for permanent pasture.

Seed Production

About 5000 acres of Italian ryegrass and 12,000 acres of short-rotation ryegrass are harvested for seed each year, the greater portion of this acreage being in the Canterbury Land District. A point of interest is that the acreage of Italian ryegrass harvested for seed in recent years has shrunk in comparison with that of short-rotation ryegrass. In 1946-47, for example, 21,000 acres of Italian ryegrass and only 5000 acres of short-rotation ryegrass were harvested. In 1953-54, however, only 5000 acres of Italian ryegrass were harvested as against 17,000 acres of short-rotation ryegrass.



Italian ryegrass seed (about 5 times natural size).

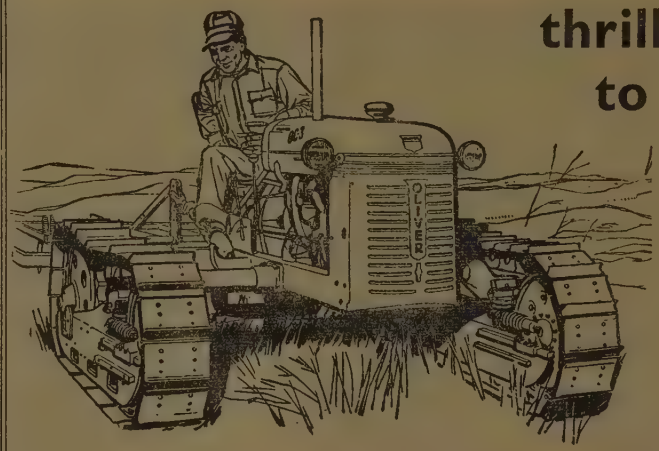
The most satisfactory way of harvesting short-rotation or Italian ryegrass is to cut it with a binder and later thresh it with a mill or header.

Methods of Sowing

The seed may be either broadcast or drilled, but the general practice is to sow lightly through every coulter of a drill in 7in. rows. Where the seed is broadcast—usually only on the heavier soils—a good seed-bed is essential. If the land is well prepared after a fallow with periodical cultivation and the moisture is present in the topsoil, good establishment may be obtained from broadcasting. However, lack of time in which to prepare a good seed-bed and absence of moisture from the topsoil are factors which often militate against good establishment by this method. Even when the seed is drilled a good seed-bed is necessary.

The advantages of drilling over broadcasting are that the seed is sown in moist soil and that fertiliser can be sown with the seed, which on the lighter, drier soils is most advantageous for rapid establishment. Cross-drilling is often used, half the amount of seed being drilled each way. A well-consolidated seed-bed is essential and care should be taken that the seed is not sown too deeply. Where the seed is cross-drilled rolling between drillings is recommended.

The sowing of 1cwt. of superphosphate per acre is desirable, especially when clovers are sown with the ryegrass. Only where clovers are sown with the ryegrass is the sowing of lime essential; the amount depends on the future planned for the area, but whatever the purpose, an applica-



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tion of ½ ton per acre will benefit the clover immensely.

In sowing areas for seed production it is essential for maintaining high quality that no uncertified seed or seed of another species of ryegrass be included in the mixture.

When the future certification of an area is contemplated only the higher classes of certified seed should be sown, such as Government Stock, Pedigree, or Mother. Further, none of these classes should be mixed at sowing, if their best utilisation is desired.

Rate and Time of Sowing

Where the saving of seed is the main objective it is essential that the seed be sown sufficiently early to allow good establishment. In many cases Italian ryegrass at 30lb. per acre is sown alone, and the area is grazed until early spring and then closed and a seed crop taken. Such areas are then broken up and sown to another crop.

The more common practice is to sow 30lb. per acre of Italian ryegrass with 2lb. to 3lb. of white clover or up to 8lb. of red clover; the first year a grass seed crop is taken and the following year a clover seed crop. On heavy soil and where soil conditions are good for establishment seedings as low as 20lb. or 15lb. of Italian ryegrass have been successful, but the more common rate is from 25lb. to 30lb.

For best results areas should be sown sufficiently early—in February or March—to allow good establishment before cold, winter weather sets in. Occasional sowings are made in April and May, but in few localities or seasons will the grass establish well or produce much feed when sown in these months. The risk of frost damage, especially when clover is sown with the ryegrass, is too great even when the seed is sown in April.

When sowings have been delayed until late autumn and a nurse crop is desirable Algerian oats at 1 bushel per acre are sown as a protection against frost lift. Algerian oats are winter hardy and will produce winter feed as well as provide protection for the young grass.

For seed production spring sowings of Italian ryegrass are not satisfactory, as the plants do not have sufficient time to stool out before running to seed, and poor crops result.

When the ryegrass is sown with clover sowing too early in autumn often causes harvesting difficulties. Under favourable conditions the clover establishes well and by harvesting time has grown up through the ryegrass, usually resulting in the crop lodging. Generally February and March sowings give the best results.

Grazing and Management

Management of an area before it is closed depends largely on seasonal conditions. Under favourable conditions, where the plants are well established and growth is well forward, the first grazing is usually taken from 6 to 8 weeks after sowing. The number of grazings obtained depends on the weather, but the earlier-sown crops may be grazed 3 or 4 times before being shut up for seed. To avoid waste and trampling of herbage feeding off with large mobs of sheep is preferable. Where the growth has become rank or is on large areas it is best to feed it off in breaks. This applies more to growth on heavy soils, though under wet conditions it applies equally to growth on light soils.

Grazing should not be too severe at any time and should be controlled so that 1in. to 2in. of leaf remains on the plants. Removing stock at this stage of growth allows quicker and better recovery of the pasture.

Late September to early October is a suitable time to close a field for seed. Areas where the soil has become pugged and consolidated through winter stocking benefit from 1 or 2 strokes of the tine harrows. In addition to breaking the hard crust of the soil harrowing helps to spread stock droppings evenly over the field.

At the time of closing the application of 1cwt. to 2cwt. of sulphate of ammonia or a fertiliser of the ammonium nitrate plus calcium carbonate type will increase seed yields considerably, especially in those crops that are backward and yellowish.

Harvesting

Areas closed for seed in September or October are usually ready for harvesting about the end of December or early January. Italian ryegrass sheds its seed very readily, and if it is allowed to become fully ripe before being harvested, considerable losses are likely. The crop should be cut when the seed is well developed and before it begins to be shed. The old test of pulling a few heads through the hand or sweeping a hat across the crop is still the best guide; if a few seeds come away from the heads when this is done, harvesting may be started. If ripening is uniform, there are no difficulties, but crops which are uneven in ripening because of variation in soil present problems, and in such cases the farmer is faced with the difficult question of when and how to harvest his crop with the minimum of loss.

Because both Italian ryegrass and short-rotation ryegrass shed their seed easily, the most satisfactory method of harvesting the crop is with the reaper and binder, and if possible, the crop should be handled in this way. The extra amount of seed saved as compared with that from other methods more than compensates for the additional cost of harvesting.

Small sheaves should be made to allow thorough drying. The sheaves are then stooked and allowed to remain in stook for 10 to 14 days or even longer.

The crop is usually carted from stook and threshed with a threshing mill, but often a mill is not available and threshing is done with a header, which

A short-rotation ryegrass crop maturing in windrows.

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is moved from stook to stook, the sheaves being fed on to the pick-up attachment. Only in the higher-rainfall districts of Southland and Otago is a crop sometimes stacked. Considerable seed may be saved when the crop is being carted to the threshing mill or stack if low trollies covered with bags or canvas sheets are used.

With a crop having a heavy undergrowth of clover, it is the practice to cut the crop and leave it in the windrow or swath. In areas where the risk of loss from wind damage is great the crop is cut slightly earlier than usual. It may be cut with a mower and left in the swath or windrowed by a windrower or mower with an inside divider attached or with a binder from which the binding gear is detached. The seed is allowed to mature and is then threshed with a header harvester with pick-up attachment. The great disadvantage of this method is that if heavy rain falls while the crop is in the windrow or swath, the seed is beaten out on to the ground and lost, whereas if it is in stook, the seed is caught in the bands of the sheaves. Also, if harvesting conditions are unfavourable the crop may have to remain out so long that it is buried by new growth.

When a crop is being cut with a mower or windrowed, the width of cut should supply just as much material as can be handled easily by the header. Too much bulk results in faulty threshing. Generally, the cut should be the same width as the cutting bar on the header.

Often harvesting is delayed by unfavourable weather and the crop becomes too ripe to avoid loss of seed when it is being cut. In such crops considerable seed is saved if cutting or reaping is done during the cooler parts of the day—morning and evening. During the heat of the day the glumes holding the seed open and the seed is shed very readily.

Direct heading is resorted to only in very light crops, and this means of harvesting helps the saving of seed on second-year areas which have been closed primarily for clover seed. The ryegrass is allowed to stand beyond the time when it is normally harvested, and when cut just above the clover flowers produces little straw, which when scattered by the spreading attachment on the header does not interfere with the clover crop. To allow thorough drying the bags should be only half filled with seed, the mouths tied securely, and the bags hung on a fence. As a safeguard against heating the bags should be turned periodically.

Italian ryegrass seed being conditioned in an unfavourable season by being hung on a fence after being threshed.

Often ryegrass seed heats in the sacks, and care should be taken that the seed is thoroughly mature before it is threshed.

Yields and Quality of Seed

Generally only one crop of seed is harvested from a stand, but in a favourable season a second crop is sometimes taken in the same season. On the heavier soils occasional good crops have been harvested in the second year. Usually such second-year crops are the result of the establishment of new plants from reseedings from seed which has been shaken or lost at harvest time. Such crops usually are too thin for handling with a reaper and binder, and the most economical means of harvesting is with a header harvester.

Climatic conditions before and after the area is closed cause yields to vary considerably. Climate governs the feed position in winter and early spring and therefore the time of closing the areas for seed. In the lower-rainfall areas, where most of the crop is produced, seed production is incidental to feed for stock. If growing conditions are favourable, good crops are the rule; if growing conditions are adverse, low yields are usual. On heavy soils yields of 60 bushels per acre are not uncommon, and as high as 80 bushels have been harvested, but on lighter soils 30 bushels of machine-dressed seed are considered a good yield. Dominion averages are about 20 bushels per acre.

The yields for short-rotation ryegrass are similar to those of Italian ryegrass but are rather higher than those of perennial ryegrass. Short-rotation ryegrass matures midway between perennial and Italian ryegrass. The greater proportion of the seed is awned, but there is always a small percentage of unawned seed. It sheds its seed readily, but to a less extent than does Italian ryegrass. Short-rotation ryegrass will establish readily from natural reseeding and in this respect is superior to both Italian ryegrass and perennial ryegrass.

Most Italian ryegrass is now bought on a machine-dressed basis, and after being threshed the seed is forwarded to seed-dressing firms for machine dressing. The loss in machine dressing varies with the quality of the field-

Short-rotation ryegrass in stook. The sheaves are allowed to remain in stook for 10 to 14 days or even longer.

dressed seed. With a good, clean line of Italian ryegrass dressing losses may be as low as 10 per cent., but average losses usually are more than 20 per cent. Foreign seed and inert matter such as pieces of straw and dirt are reduced to a minimum by machine dressing. The worst seed impurities and the hardest to dress out are goosegrass *(Bromus mollis)*, hairgrass *(Vulpia*, spp.), and well-developed ribgrass *(Plantago lanceolata)*.

A good-quality line is bright, well-awned, and of high purity and germination. For export, lines with a minimum of 98 per cent. purity and 90 per cent. germination are sought, and prices for all lines are based on this standard.

Strains of Italian Ryegrass

There has been considerable confusion about strains of Italian ryegrass. Certain alternative names such as "Giant Italian" and "Western Wolths" are used in the seed trade, but if these names ever had any real value, they have none now. True Western Wolths is certainly a distinct type of ryegrass of Dutch origin, making extremely rapid growth but having little power of recovery after being cut. If this strain was ever present in New Zealand, it has now lost its identity completely.

Much of the so-called Italian ryegrass seed produced a decade ago consisted of inferior types resulting from indiscriminate hybridisation with perennial ryegrass, and after heavy dressing, which removed most of the awns present, this material was marketed alternatively as "ryegrass" or as "Italian", depending on the state of the market at the time for perennial ryegrass and Italian ryegrass seed.

This deterioration of type paralleled a similar deterioration in perennial ryegrass, but was not offset by the development of improved strains in certain localities as happened with the perennial species. As a result the quality of the so-called Italian ryegrass seed on the market during the 1920s and early 1930s left much to be desired, and only with the importation of fresh material from Europe about 1934 was the way prepared for an all-round improvement in quality. Consequent on this introduction seed certification was inaugurated, and it is significant that not one line of Italian ryegrass seed then on the market in New Zealand succeeded in qualifying under this scheme.

Parallel with the importation of this strain the Grasslands Division of the Department of Scientific and Industrial Research began a programme of selection work on Italian ryegrass which has led to the release of a pedigree strain markedly superior to the original importation in both production and recovery in the second season. This strain now forms the basis of seed certification.

Short-rotation ryegrass, which is a product of the Grasslands Division, is the result of an artificial cross made between perennial ryegrass and Italian ryegrass. Methods of seed production resemble closely those used with Italian ryegrass, and to this extent short-rotation ryegrass may be regarded as a strain of Italian ryegrass.

Seed Certification

A certification scheme covering Italian ryegrass seed was begun in the 1934-35 season, while a similar scheme for short-rotation ryegrass was begun in 1944-45. Under this scheme the following classes are recognised:—

Government Stock seed: Produced on contract to the Department of Agriculture from areas sown out with nucleus lots raised by the Grasslands Division. To secure this class of seed applications are made through a merchant to the Department of Agriculture.

Pedigree seed: The produce of areas sown with Certified Government Stock seed.

Mother seed: The produce of areas sown with Certified Pedigree seed.

Standard seed: Seed harvested from areas sown with Certified Mother seed.

Seed of the Pedigree, Mother, and Standard classes is procurable through commercial firms.

All crops entered for certification are inspected in the field to ensure purity of type, and before a line is finally tagged and sealed as Certified seed it must reach a minimum standard of 98 per cent. Supervision of the seed through all stages of certification from the time of harvesting to the machine dressing and final tagging and sealing of the sacks is done by field officers of the Department of Agriculture, and samples of the seed are plot tested for confirmation of the type of plant.

The same provision is made for the certification of both short-rotation ryegrass and Italian ryegrass, with the exception that all areas of short-rotation ryegrass are degraded a class after passing through two harvest seasons, whereas Italian ryegrass areas are degraded after the first harvest.

The annual production of Certified Italian ryegrass seed of all classes has amounted in recent years to about 50,000 bushels, and that of short-rotation ryegrass has been about 250,000 bushels.

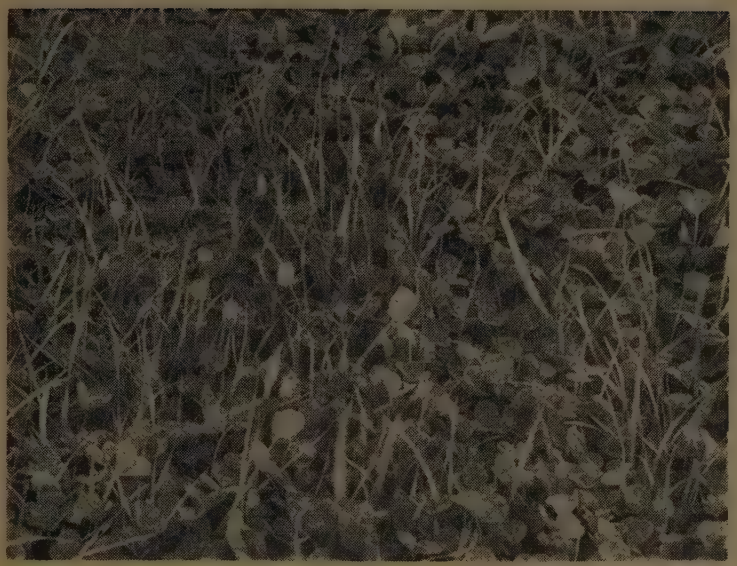
Insect Pests and Fungous Diseases

Grass-grub and Porina

In isolated cases stands 3 to 4 months old have been damaged by grass-grub *(Costelytra zealandica)* and porina *(Oxycanus* sp.), but generally the worst damage occurs in second-year stands where clover has been sown with the intention of taking clover seed crops. Both the grass-grub and porina can be controlled with 2lb. of 100 per cent. DDT (or its equivalent at weaker strengths) per acre in whatever is the normal superphosphate dressing rate for the particular district. The insecticide-treated superphosphate should be applied to close-grazed, dry pasture as soon as the grubs or caterpillars are known to be present. The above treatment will give good control for from 2 to 3 years.

Wheat Sheath Miner

Though growing crops are remarkably free from insect attack, damage by the wheat sheath miner *(Cerodonta denticornis)* occurs occasionally in isolated areas, but so far it is not considered a serious pest. Damage in the crop is characterised by premature whitening of the seed heads. The wheat sheath miner is a small greyish fly with yellow legs and one pair of transparent wings. The adult female lays its eggs within the leaf tissue. The eggs hatch out within a week and the grubs begin burrowing in the leaf tissue. The burrows are minute at first, but as the grubs grow the tunnels become larger and can be seen easily as white lines on the leaf. When these tunnels are numerous the flow of sap is cut off and the leaf wilts and dies. When the stems of plants are attacked the sap is cut off from the developing seed heads and the damaged stems appear as white straws in the crop.



A 30-month-old stand of Italian ryegrass and white clover from which a crop of ryegrass seed was taken in the first year and a clover seed crop at the second harvest.

Rust

Italian ryegrass is not susceptible to any serious insect pests or fungous diseases. Occasional crops may be affected with rust, but the damage is usually slight. In severe attacks ripening is immature and the seed light. There is no practicable means of control for rust, and the incidence of the disease is controlled by climate.

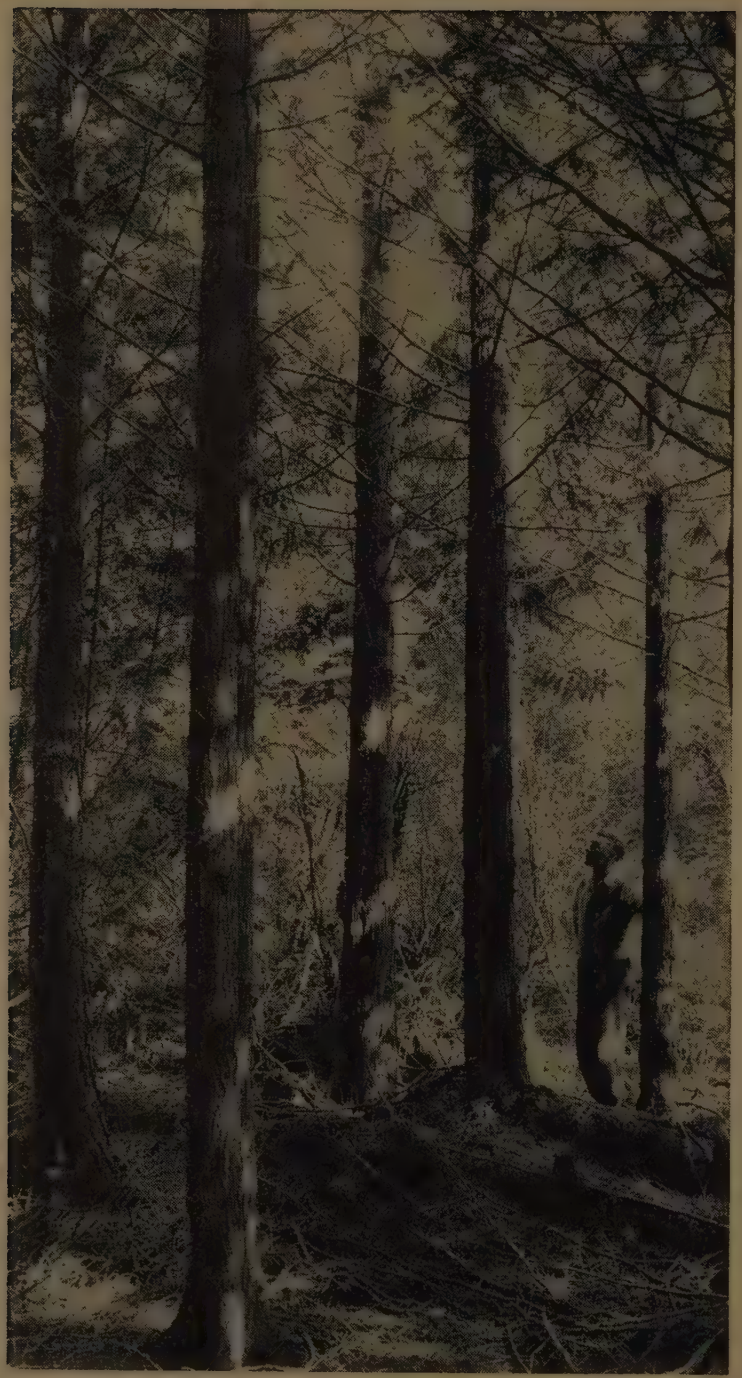
Blind Seed Disease

Italian ryegrass is less susceptible than perennial ryegrass to blind seed disease, but under favourable conditions this fungus does attack Italian ryegrass. Wet, humid weather at flowering time favours the growth of the fungous, which enters the seed and kills the embryo. The seed appears normal when harvested, but will not germinate. The Department of Agriculture provides a service whereby growers may have their crops tested for infection before harvest. Samples of heads representative of a crop should be forwarded to one of the local stations set up at convenient centres. The correct time to sample the crop is as near to the harvesting stage as is possible. After the seed has been tested the grower is advised of the percentage of infection present.

Exports and Prices

The area of Italian ryegrass and short-rotation ryegrass saved for seed depends primarily on seasonal conditions, but is also influenced by price, which in turn is governed by overseas demand. Sufficient seed is always grown to meet the New Zealand demand, but in recent years the demand from overseas has developed a considerable export trade. The United Kingdom and Australia have been the chief markets for a number of years.

Short-rotation ryegrass and the high-producing strain of Italian ryegrass have been developed to suit New Zealand conditions, but encouraging reports on their behaviour under overseas conditions have been received. Though the saving of areas for seed is regarded as of secondary importance to the production of feed for stock, seed production can add considerably to a farmer's income, and if the Dominion is to retain these overseas markets, the high standard of strain and quality must be maintained.



Western red cedar, 25 years old, in Mahinapua State Forest. It was planted about 10 years after the land had been logged.

Trees on the Farm

Trees Suitable for Westland

THERE are often requests for names of tree species suitable for certain localities, and to meet this need lists are being compiled by district officers of the New Zealand Forest Service. This list for Westland by W. H. Jolliffe, Extension Forestry Officer, New Zealand Forest Service, is the second in this series, the first having appeared in the February issue of the "Journal".

IN Westland the main factors affecting the choice of trees are the high rainfall, accompanied in many parts by poor drainage, frequent salt-laden winds, the presence of browsing animals, often in considerable numbers, and, on recently logged areas, the danger of attack by the honey fungus (*Armillaria mellea*).

The honey fungus, so called because it has a honey-coloured, mushroom-shaped fructification, commonly grows harmlessly on dead roots and fallen logs. However, it is capable of becoming parasitic on almost any plant with a large root system. Coniferous trees are particularly susceptible to this type of attack, which is often slow in developing and may not kill a planted tree until it is a fairly large sapling. Dying trees will then be found to have a papery, black and white fungous layer between the bark and the wood at the base of the tree.

The real problem areas are those where "pakihi" soils predominate. In these areas between 18in. and 36in. from the surface is coarse shingle cemented by iron to form an impermeable pan, which is responsible for the permanent waterlogging of these soils. Before such places are planted it would be wise to seek local advice from offices of the New Zealand Forest Service at Hokitika, Ahaura, Reefton, and Westport. Generally the recommendations given here apply to planting on sand-dune country and on hills and terrace edges such as may be found, for instance, in the Grey River system.

Where indigenous forest has been cleared within recent years honey fungus is a menace which will attack many species. Greater immunity has been found among hardwoods, including eucalypts, than among conifers and it would be wise to select one or more of the former.

Where browsing animals are common unpalatable species must be

chosen. Many of the native ones, notably the beeches, rimu, and the podocarps, are not touched, but few of the exotic species are immune. Several of the eucalypts may be exceptions to this rule, but the only one so far proved free from molestation is *E. gigantea.*

Recommended Species

Species recommended for Westland, with certain limitations as to site, are:—

Alnus spp. (alders) are deciduous broad-leafed trees used mainly for firewood. They grow well on moist sites, but do not like salt winds.

Araucaria excelsa (Norfolk Island pine) is a conifer suitable for coastal sites.

Betula verrucosa (silver birch) is a deciduous broad-leafed tree which will tolerate cold, damp sites.

Chamaecyparis lawsoniana (Lawson's cypress) is an excellent shelter tree suitable for better and drier sites, but has strict limitations. It will not survive wet places or salt winds, it is very susceptible to honey fungus, and it is readily browsed.

Cryptomeria japonica (Japanese cedar) is a conifer which likes early shelter and so is a good tree for under-planting open, grown stands.

Cupressus macrocarpa (macrocarpa) is a good farmers' tree, but it should not be planted on wet sites. Perhaps it is the exotic most tolerant to salt-laden winds.

Eucalyptus spp. (eucalypts): Not many of this huge group can be grown in forest form as far south as Westland, but those which have been successful are *E. gigantea, E. globulus, E. macarthuri, E. obliqua, E. regnans,* and *E. viminalis.* None of these likes salt winds.

Larix leptolepis (Japanese larch) is a deciduous conifer requiring a well-drained hill soil. It produces a durable timber slowly. It is more tolerant than the European species.

Picea spp. (spruces) are coniferous trees which do well on damp, misty high country, but are unthrifty on the flat, especially near the sea. *P. sitchensis* is not damaged by browsing animals, but is subject to attack by honey fungus.

Pinus laricio (Corsican pine) is somewhat slow growing, but is suitable for planting on dredge tailings and on well-drained hilly sites.

P. murrayana (lodgepole pine) tolerates poor sites better than most other species. It is not recommended for better-class country.

Radiata pine, 26 years old, at Mahinapua on a well-drained site. The tree in the centre is nearly 17in. in diameter and 100ft. high.

P. pinaster (maritime pine) is a good coastal tree which will do equally well in the hills provided there are not many browsing animals. Some strains, however, do not develop into good form trees.

P. radiata (radiata pine) is quick growing and easy to handle, but should not be planted in wet sites or at too great an altitude. It tolerates salt winds very well.

Populus nigra var. *italica* (Lombardy poplar) is a good shelter tree if planted close enough and will do well in most soils away from the sea.

Pseudotsuga taxifolia (Douglas fir or Oregon pine) is a valuable timber tree requiring a well-drained soil away from the sea. It is very subject to browsing.

Thuya plicata (Western red cedar) is a valuable timber tree for better-class soils not subject to salt winds.

Trees Not Recommended

Species which are not recommended for forest use, even though they may be successful as garden specimens, are *Acacia decurrens* (black wattle), *Cedrus* spp. (true cedars), *Pinus caribaea* and *taeda* (southern pines), *P. ponderosa* (ponderosa pine), *P. strobus* (American white pine), *Populus* spp. (most poplars other than Lombardy poplar), and *Sequoia sempervirens* (redwood).

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Hive Management for Section Comb Honey Production

By E. SMAELLIE,
Apiary Instructor,
Department of Agriculture, Auckland

TO ensure a full yield of first-class honey sections it is important that colonies' maximum hive strength should coincide with the beginning of the main honey flow. In building up this strength before the main flow colony management for section honey production is similar in every respect to that for extracted honey production. However, management requirements once the main honey flow begins are in distinct contrast. With extracted honey production the aim in colony management is to avoid congestion and overcrowding, whereas for section honey production it is necessary to restrict the brood nest and maintain crowded conditions within the hives so that the bees are forced to accept and store the surplus honey in the section combs. These conditions induce swarming, and this problem and the natural reluctance of the bees to work in section supers are the main difficulties for the beekeeper to overcome in producing crops of section honey. In this article, the second of a three-part series, the author describes the requirements for the production of a full crop of good honey sections. In last month's "Journal" the preparation of equipment was discussed. The concluding article in the series, in next month's "Journal", will describe the preparation of honey sections and cut comb honey for market and export.

COLONIES selected for producing sections must be very strong, consisting of at least two full supers of brood and bees and a young, vigorous queen. Colonies that are weak and strains of bees that are inclined to undue swarming are useless. These should be used instead for extracted honey production.

As soon as the flow begins the colonies selected are reduced to a single-story brood nest filled out with combs of capped brood. A queen excluder is fitted over the brood chamber and, according to the flow conditions, one or two supers of sections are placed above it and the hive roof is replaced. To complete this operation the bees on the remaining combs are shaken in front of the hive and the surplus combs and brood are then transferred to other weaker colonies or used to make nucleus hives.

A colony of suitable strength and condition to produce section honey.

The colony reduced to a single brood chamber filled out with capped brood and with a queen excluder in position for the duration of the honey flow.

Fully Capped Combs Very Important

Placing fully capped combs of brood in the brood nest is very important in section honey production. Not only will the bees that are about to emerge be able to take over duties within the hives and in this way free more bees for field work, but the queen will have room to lay eggs almost immediately. It must be realised, however, that with this manipulation an artificial condition of crowding and environment has been created, and that the natural reaction of the colony will be to raise queen cells immediately in preparation for swarming out. Therefore, checks for queen cells must be made in every hive at 8- or 10-day intervals and all queen cells destroyed until the colonies have settled down and lost the swarming impulse.

A half-depth super of section frames has been placed above the queen excluder.

The hive set up for section honey production at the beginning of the honey flow. Additional ventilation has been provided at the entrance by raising the hive on blocks and through a screened opening in the hive roof.

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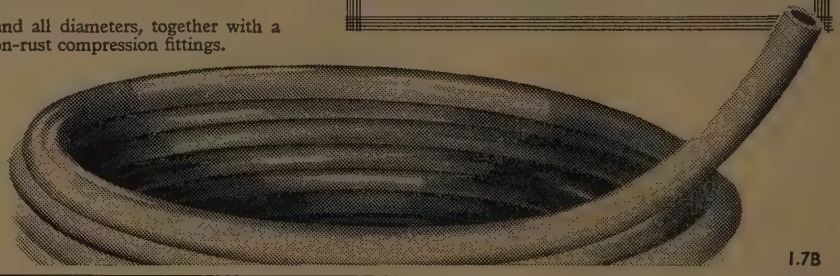

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The reluctance of bees to enter section supers and the problem of unfinished sections can be reduced by the use of bait sections and of drawn extracting combs. Above—A bait section placed in a section frame. Right—Drawn extracting combs placed at each side of the sections. With this arrangement the extracting combs centre the section frames above the brood cluster and reduce the number of unfinished sections usually found at the sides of the super.

Preventing Swarming

Other measures which will assist the beekeeper to prevent or control swarming are the use of young queens of a suitable strain for section work; the use of good worker combs in the brood nests to prevent the rearing of unnecessary drone bees; the use of bait sections and the proper manipulation of honey supers to reduce crowding in the brood nest; provision of additional ventilation during the flow by enlarging the entrances or by raising the hives on to blocks; and, wherever possible, the provision of shade to prevent overheating within the hives. Attention to each of these measures is important.

Any interruption of the honey flow or any major changes in the weather at this time will also induce swarming, and should swarming occur to any extent, the crop average for the season's work will be considerably reduced. The beekeeper, therefore, must use every endeavour and skill to prevent or control the bees' impulse to swarm and yet keep each colony sufficiently crowded to get all the sections well finished.

A honey section spoilt by brace comb as a result of incorrect spacing of the frames.

▼ A full crop of well-finished honey sections before harvesting.

A half frame of first-grade sections.

Size of Supers

Both full-depth and half-depth honey supers are used by beekeepers for holding the sections; however, there are distinct disadvantages in using full-depth supers for section honey production. First, there is the difficulty of assembling the sections in the larger frame holders, and again later there is the difficulty of removing the finished sections without causing any damage to them. In addition, sections in the larger frames become much more travel stained by the bees, owing to being on the hives for the much longer time that it takes to get the extra number of sections finished. Also when these larger supers are full and they have to be removed from the hives their extra weight makes them difficult to handle and it is hard to avoid damage to the sections.

With the removal of honey from the hives after the flow has ceased robbing is troublesome. Unless the supers are covered with sacks as they are taken from the hives many sections will be spoilt by broken cappings or honey weeps as a result of robbing by bees.

The half-depth super is much more versatile for supering with sections, and as it is lighter to work with, the majority of producers favour its use. The reluctance of bees to enter section supers and the problem of unfinished sections can be reduced by the use of bait sections and of drawn extracting combs. An effective procedure is to place an extracting comb at each side of the sections in the super above the brood chamber. This manipulation centres the section combs immediately above the brood cluster and the extracting combs above where there is generally no brood. With this arrangement the extracting combs attract the bees into the honey super and at the same time this eliminates the usual problem of unfinished sections at the sides of the super.

Provision of Supers

The vigour of the honey flow and the condition of the colony will determine the rate and timing of any additional supering. Where the flow conditions are good extra supers may be added slightly before they are needed, but too many should not be given at one time; usually one super at a time is sufficient. To give supers as needed necessitates careful observation of the nectar sources and no general rule can be laid down, except that with over-supering the excess space will result in poorly finished and partially filled sections. However, if nectar is coming in rapidly and steadily, a second super may be added when the first is about three-quarters full. In any event supers must not be added before the bees are in actual need of more storage space.

When the prospect indicates that an extra super of sections will be filled and completed, it should be placed below the other supers already on, next to the brood nest. If the honey is slow coming in, or if the flow is liable to cease, the new super should be placed above others that are already on the hive. Once most of the sections have been fully capped the super should be removed from the hive as soon as possible to avoid travel staining of the sections.

Removal of Honey

With the removal of the crop great care is necessary to avoid damage to the finished sections. Some beekeepers clear the bees from supers with smoke, but this often results in smoke taint in the honey and in bees uncapping the cells to gorge themselves with honey. These difficulties can be avoided and the work expedited generally when bee escape boards are used. If the escape boards are put on in the evening, it is usually possible to remove the supers, free from bees, the following morning.

With the final removal of honey from the hives after the honey flow has ceased it is necessary to take every precaution that will prevent trouble and damage by bees robbing the honey. After a season's work it is very annoying when the sections are spoilt for market with broken cappings and honey weeps as a result of bees robbing. This trouble can be prevented by covering the supers as they are taken from the hives and removing them at once to the honey house.

All sections should be checked over at the honey house and any unfinished sections sorted into separate supers for return to strong hives for final finishing if the season is not too far advanced, or for the bees to clean out so that they may be used for bait sections in the following season.

Supers with sections that are to be stored in the honey house should be tightly stacked to about head height, but the stacks should be so arranged that each can be fumigated at regular intervals to ensure that none of the crop will be spoilt by wax moth infestation during the storage period.

Where the storage of sections cannot be avoided the storage temperature should be held at not less than 70 degrees F. and the room conditions must be kept dry. Once section honey has been removed from the hives, however, it should be prepared for market and sold as soon as possible if risks of deterioration are to be avoided.

Farm Building Construction

By H. W. T. EGGERS,
Engineer, Department of Agriculture, Wellington

[*National Publicity*

ALL types of farms require a variety of buildings for efficient management, and the rebuilding of old structures and the erection of new ones are not always easily arranged. To help the farmer construct his own buildings with due regard to the correct choice of materials, utility, appearance, long life, and economy, a series of articles is to be published in the "Journal". The subject of this article, the first of the series, is foundations, and subsequent articles will deal with framing, roofing materials, sheathing, flooring, joinery, internal finish, and new methods of building and new materials.

THE first step in planning a building is to decide the room or compartment sizes and their shapes, total floor area, type of construction, its appearance, and how it can be serviceable or useful.

These decisions result in a basic plan or concept of the finished article which if acceptable to the would-be owner, can be made real by construction.

This stage of planning for simple structures is comparatively easy and for such buildings as sheds and hay barns decision about length, width, and eave or stud height is all that is necessary.

For more complicated structures such as dwellings or buildings in which rooms or partitioned areas are required this stage of planning can be greatly assisted by the use of squared graph paper, on which outline sketches can be drawn to a definite scale of, say, ¼in. square representing 1 sq. ft. This method saves scaling and ensures all corners being true right angles.

As soon as planning of complicated structures such as a dwelling has reached the basic arrangement stage professional advice should be sought. Sketches and ideas can be taken to an architect, who with his knowledge and experience will produce a floor plan incorporating all requirements to the best advantage. He will arrange rooms and cupboard space to give best utility, be able to minimise waste space, arrange windows and orientation to give maximum light and sunshine, and, in short, apply his experience to the benefit of his client by avoiding those pitfalls which await the amateur designer.

Siting in relation to sunshine and shelter from winds, proximity to other buildings, view (if a dwelling is planned), ground water, and access both for construction and afterward must be studied, and the architect will orientate and site the building with consideration to them.

In the final drawings the architect will prepare elevations which will show the finished structure as it will appear from the outside, thereby permitting any desired alterations to be made before construction is begun.

This planning or paper stage (the evolution of plans for building permit requirements) is of the utmost importance, because once construction has started alterations cannot be made without involving considerable expense, and cost is the item which has probably influenced the planning throughout.

Building Permits

Before construction of most buildings, but particularly dwellings, is begun most local bodies require the issue of a permit for construction to ensure that the proposed building meets with requirements in regard to structural soundness, sanitation, fire hazard, etc., and, if it is a dwelling, to ensure that it is not below minimum standard requirements for human habitation.

In urban areas the issue of a permit also controls the standard of construction in relation to the locality. For example, a permit would not be issued for the erection in a residential suburb of a garage or shed built with packing cases and old iron.

An application for a building permit must be made to the local body and should set out:—

1. The legal description and particulars of the site (D.P. number, etc.).

2. The full name and address of the applicant, the locality of the proposed

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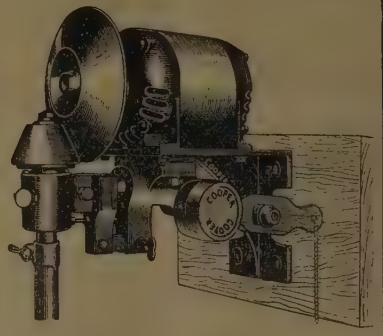

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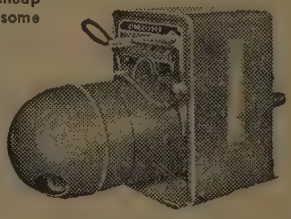

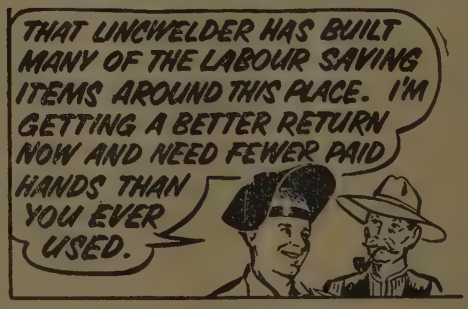
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work, and the estimated cost of such work.

3. The proposed use or occupancy of every part of the building.

4. Information as to the nature of the ground on which the building is to be placed and the adjacent strata.

Most local bodies issue their own special permit application forms which detail the information required.

With each application there is usually required in duplicate detailed plans, elevations, cross section, and specifications, which together furnish complete details of design and qualities and descriptions of all materials of construction and workmanship and which should be sufficiently clear to show to the satisfaction of the local body the exact nature and character of the proposed undertaking and the provision made for full compliance with the requirements of the local by-laws.

Laying out the Building

Carrying the planning of the building through to the permit stage will have provided the drawings from which construction can be carried out. The next step is to set out the foundations on the site and procure construction materials.

If materials are readily available and can be procured at short notice, it is preferable to arrange delivery as required to keep the operation going rather than to have to store large quantities on the site. Storage of some stock may be necessary, but should be kept to a minimum compatible with maintaining continuity of operations. Ordering of materials should be done well ahead of expected time of requirement to enable suppliers to deliver before or when the material is required.

Every builder should compile a list of requirements for each phase of the work and arrange for their being available on the site when needed. Considerable organisation by the builder and co-operation from suppliers are usually required.

Laying out the site and digging of the foundation trenches can be carried out as follows:—

From the foundation plan prepared for the permit application the levels of the corners of the building in relation to the ground can be decided and these must be defined with markers which also define the foundation measurements as shown in Fig. 1. These corner markers should be of the same height as the finished foundations and a convenient distance from the position of the foundations to permit excavation and construction to be done without the markers being disturbed. They will no longer be required when the foundations are placed and levelled.

To mark out a right angle for corners the 3-4-5 system should be used; that is, a triangle having two sides of 3ft. and 4ft. respectively and a hypotenuse of 5ft. will have a 90-degree angle contained by the 3ft. and 4ft. sides.

Marking out on the flat is comparatively simple, the longest side of the building being used as a base line and the rest constructed from it. Final marking can be checked for square by the measuring of diagonals, which should be equal.

If the contour of the ground is uneven or steep, marking out and levelling are more difficult, particularly if the slope is very steep. Fig. 2 shows the method of measuring in the horizontal when marking out is done on slopes. A straight-edge about 12ft. long machine dressed from 4in. x 1in. timber is a handy tool for this work.

Levelling of corner markers as shown in Fig. 1 is best done with a dumpy level, which must be worked by an experienced operator, as practice is necessary for its efficient use. If one of these levels is not available, a straight-edge and a good 2ft. 6in. or 3ft. carpenter's level if carefully used can give quite satisfactory results.

If side C D in Fig. 1 is being used as a base line and the end D is the higher, a rough check is taken with the straight-edge level and rule as shown in Fig. 2 to ascertain the difference in level of the site from back

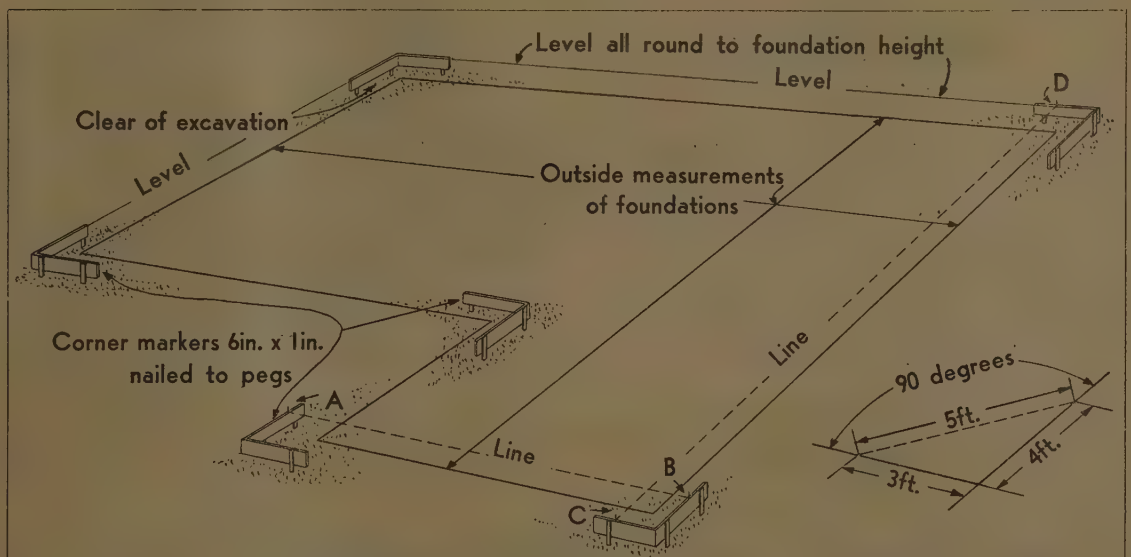

Fig. 1—Marking off foundations. Marking lines are stretched tightly from nails A and B and C and D in the corner markers and the edge of the foundation excavation is cut vertically below these lines. Once the edge line is cut in the ground with a spade the marking lines can be removed. This procedure is carried out for all sides of the building. The smaller diagram at right shows how right angles are marked off.

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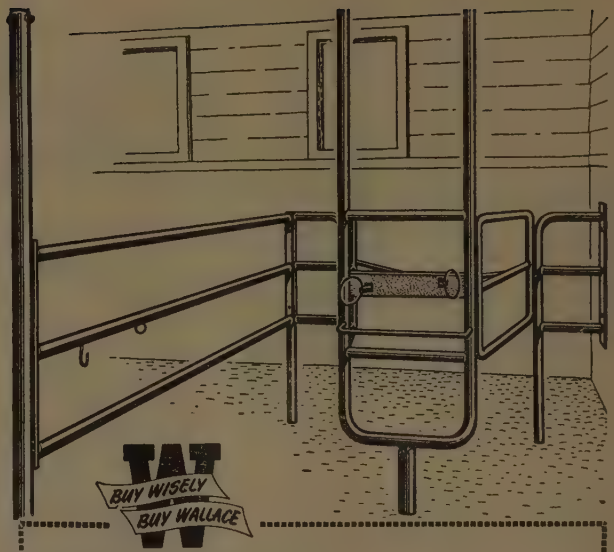

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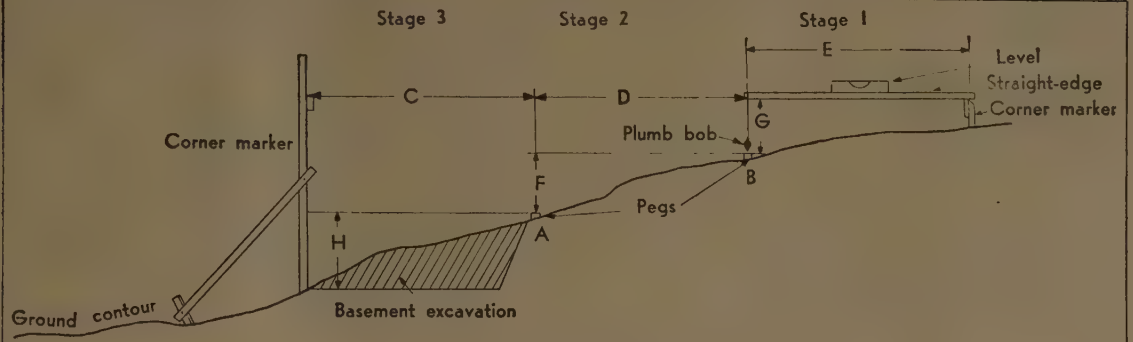

Fig. 2—Method of measuring in the horizontal when marking out is done on slopes. In stage 1 a straight-edge with a plumb bob hung over one end is levelled on the top corner marker and a peg B driven into the ground directly under the bob. With the plumb bob at rest and the level true a pencil mark is put on the face of the peg to mark the plumb bob centre and measurement E is taken. In stage 2 the straight-edge is levelled on peg B and the operation done in stage 1 is repeated with peg A, measurement D being taken; in stage 3 the straight-edge is levelled on peg A, measurement C being taken. The total horizontal distance is E + D + C. Vertical measurements are taken from the lower edge of the straight-edge to the top of each peg; these are shown by G, F, and H, which give the difference in levels between the corner markers.

to front of the building. If this difference is reasonably small, no excavation will be required, levelling of the floor being done with the foundations.

If the difference is appreciable, it will be necessary to excavate the high side to reduce the floor height above ground on the low side. The depth of this excavation will depend on the difference in level and the amount of foundation required on the low side; that is, the type of basement facilities that are provided for in the plan.

Though it is good practice to take advantage of basement facilities offered by contour, a balance should be arrived at between excavation and foundation height where the site is very steep or where no basement is required. This balance will largely depend on relative costs of the two items and may also be influenced by the desirability or otherwise of a bank at the back of the house.

If a basement is required and no excavation or lowering of the back of the house is necessary, reasonably accurate levelling can be done in the same way as suggested for horizontal measuring in Fig. 2, a rule being substituted for the plumb bob.

If it is remembered that all measurements must be taken in the horizontal and vertical planes only and that the plumb bob, straight-edge, and level indicate these planes, the amateur builder will soon learn how to use them to his advantage.

Piles for flooring support must be cast inside the external foundations at positions shown on the foundation plan. Their spacing will depend on the floor loading and any provision made for unimpeded basement room. Internal pile foundations are not always the same height as external foundations; some may be higher and some lower, depending on the thickness of plates and joists they support in relation to floor level. If floor level is calculated and taken as the basis of workings, any variation in vertical measurement of piles can be calculated from the drawings by adding or subtracting the thickness of plates.

When external foundations of the continuous wall type are cast a sound practice is to leave a chamfer on the outside edge by tacking a triangular fillet to the boxing. The purpose of this will be explained in a later article in this series. This is shown in section in Fig. 3.

Basement Excavation

If provision is to be made for a basement, excavation should be done before the foundations are run, due regard being given to the position of floor piles and long floor spans, which will affect the size of floor joists. This is shown in Fig. 2.

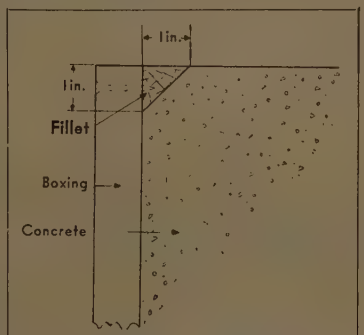

Fig. 3—Method of obtaining chamfer on continuous wall external foundations.

On some very steep sites it may be advisable to erect the front foundation wall and fill in for a level basement floor from excavation from the back of the building.

Any excavation at the back of the building to lower floor level in the front should extend at least 3ft. from the building and be sloped away from the foundations so that water flows away from the building.

Any excavation that is required is better carried out before construction begins.

Preparation of Site

"The New Zealand Standard Code of Building By-laws" makes recommendations concerning the preparation of a building site such as the thorough cleaning of the site, removal of all vegetation and noxious matter, and draining so that no water can lodge.

There are recommendations covering unusual circumstances such as presence of a watercourse, a stream, or extreme wetness. In these or in any other cases of doubt the advice of the local body's engineer should be sought.

Function of Foundations

The foundations of any structure serve as the medium of transmission to solid earth of all the forces imposed on that structure and if the structure is to last, the foundations must be amply capable of performing this function.

Load-carrying Capacity

Though the forces imposed on the structure of a building are not all vertical, their transmission to the soil through the foundations is arranged by structural design to result in a ver-

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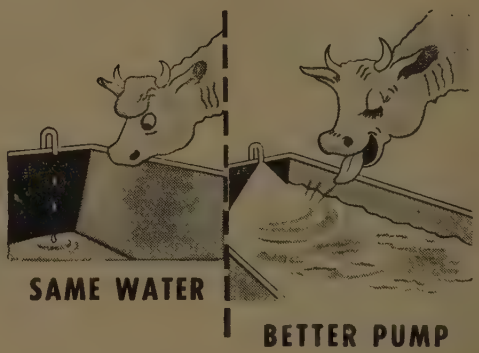

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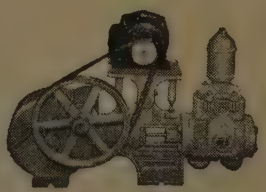

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tical plane. All the forces in the structure—its own weight, the load it carries, the pressure exerted on it by wind, and stresses due to earthquake—result in a downward loading producing a compression stress on the foundation.

Though earthquake reaction in a building results in compression stresses in the foundation, other stresses also occur through the simultaneous action of earth movement. These stresses, in combination with the building stresses, if severe, may cause failure of building foundations.

In planning a building the designer takes into consideration all the forces imposed on the structure. These are classified broadly as (a) dead load and (b) live load.

Dead load includes those forces which remain static, such as the superimposed weight of the structure. Live load includes those forces which can move or change, such as loads imposed on floor area and wind pressure on the external walls.

As foundations are under compression and are carrying the full weight of the building plus its load (if the floor is supported), they must be of sufficient area to transmit that load to the ground without displacement of the soil on which they rest. In other words, the load per unit area of foundation must not exceed the safe load-carrying capacity of the soil.

Table 1 gives the safe load-carrying capacity of various soils.

To find the foundation area required for buildings on any particular soil, the total weight imposed on the foundations must be calculated. This, divided by the safe bearing capacity of the particular type of soil, will give the foundation area in square feet. The total weight will include the weights of all materials used in construction plus allowances for live load, which includes any floor loading carried by the foundations and an allowance due to wind pressure on the structure.

Foundations may be divided into two categories: (a) external (supporting outside walls) and (b) internal (supporting inside walls and floors). Both may be either continuous wall construction or pile foundation, depending on the design of the building and the weight they are required to support. The bearing area of piles is much less than that of continuous walls, so for economy's sake piles are usually used for supporting relatively light loads such as floors.

The exterior walls of light buildings, such as sheds, may often be more economically supported on piles than on a continuous wall construction. More heavily built structures, such as dwellings, may have the external foundations continuous wall and the internal foundations piles, or the external foundations may be wall at the corners for added strength with piles between.

TABLE 1—SAFE BEARING CAPACITY OF SOILS

Nature of soil	Safe bearing capacity tons/sq. ft.
Alluvial soil, made ground, very wet sand	½
Soft clay, wet or lose sand	½
Ordinary fairly dry clay, fairly dry fine confined sand, sandy clay	1½
Medium clay, stiff but capable of being spaded	2 to 3
Loose, medium, and coarse sand, fine dry sand (confined)	2 to 3
Gravel, coarse sand in natural thick beds (confined)	3 to 4
Hard clay requiring picking for removal	3 to 4
Compact sand and gravel requiring picking for removal	4 to 5
Soft rock, disintegrated ledge, natural ledge difficult to remove by picking	5 to 8
Hard-pan cemented sand and gravel difficult to remove by picking	8 to 10
Solid shale and other medium rock requiring blasting for removal	10 to 15
Solid ledge of hard rock such as granite, trap, etc.	25 to 50

Footings

As the material used for foundations, whether wood or concrete, is usually much more resistant to compression stresses than the soil on which the foundations rest, the sectional area above that required to transmit the load to the soil can be considerably reduced. Foundation walls may be stepped above the footing and piles may be stepped or tapered. This practice does not impair the load-carrying capacity of the foundations if the reduction in section is not permitted to go below safe limits for the particular material used.

Fig. 4 shows the construction of foundation walls with footings and also the proportioning of piles.

The minimum reinforcement for continuous concrete footings is given in Table 2.

TABLE 2—MINIMUM REINFORCEMENT FOR CONTINUOUS CONCRETE FOOTINGS

Height of building in storeys	Width of footings	Reinforcement
1	Not exceeding 6in.	One ⅜in. rod
	Exceeding 6in.	Two ½in. rods
2	Not exceeding 8in.	Two ½in. rods
	Exceeding 8in.	Three ½in. rods
3	Not exceeding 9in.	Two ⅜in. rods
	Exceeding 9in.	One ⅜in. rod and two ½in. rods

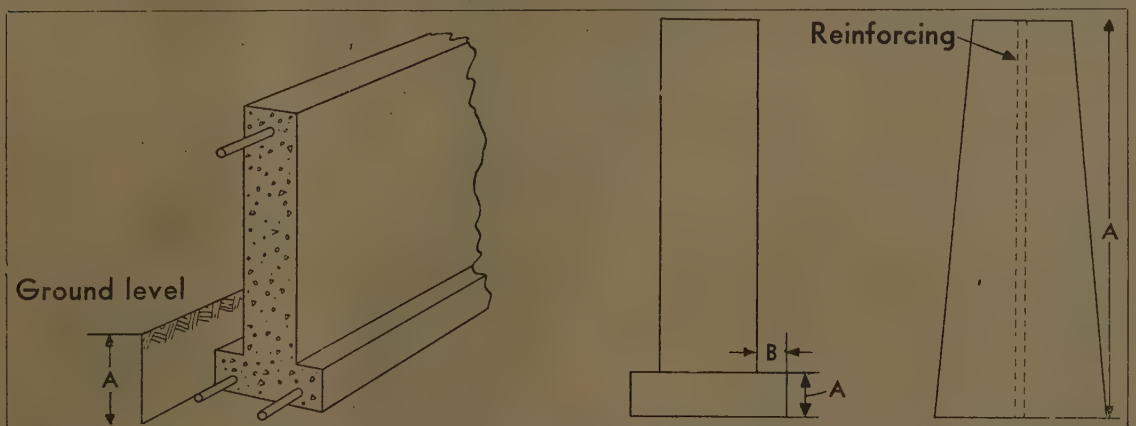

Fig. 4—Construction of foundation wall and piles. Left—Foundation wall and footing, showing reinforcing (see Table 2). A is to be not less than 8in. Middle—Parallel pile and footing. A is to be not less than 4in. or double B, whichever is greater. Right—A tapered pile. Reinforcing is required if A is more than 2ft. 6in.

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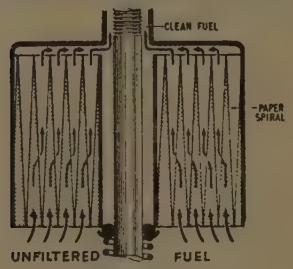

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Distribution of Load

The load carried is distributed over the external and internal foundations in proportion to weight; with continuous wall it is the weight immediately above plus any adjacent floor loading and with piles it is the weight above plus the weight on half the span distance to adjacent piles on either side.

Proportioning of foundation footings for either walls or piles can be calculated accordingly. The following hypothetical case of a shed is an example (see Fig. 5).

Dimensions: 30ft. long by 20ft. wide (say, 600 sq. ft. area).

Roof: Single span trussed gable.

No load-carrying partitions.

Floor: Supported on piles and external foundations.

External foundations: Continuous wall.

Soil: Dry clay of safe-bearing capacity of 1½ tons per square foot.

Weight of roof, including framework and sheathing: 10 tons.

Weight of walls, including framework and sheathing: 20 tons.

Weight of floor, including joists: 17 tons.

Live load on floor at 200lb. per square foot: 53 tons.

The external foundations 6in. wide in Fig. 5 would have a ground bearing area equal to 49 sq. ft.

Six-inch square piles placed in rows approximately 5ft. apart and with 4ft. 2½in. between piles give a ground bearing area of ¼ sq. ft. per pile or 4½ sq. ft. for 18 piles.

The loading of the external foundations consists of the weight of the roof, 10 tons, weight of walls, 20 tons, and weight of floor plus live load over area shown hatched. This area is half the distance between the external foundations and the internal rows of piles and represents an area of approximately 187 sq. ft., or nearly three-tenths of the total area.

The total floor weight dead and live loads is 70 tons, of which three-tenths or approximately 21 tons is carried by the external foundations and the remaining 49 tons by the piles. This brings the total external foundation loading to 51 tons, which, distributed evenly over 49 sq. ft., gives a soil loading of just over 1 ton per foot, which is well within the safe bearing capacity of the soil. The external foundation wall can therefore be provided with a 6in. wide footing with safety.

The loading of 49 tons on the piles, with their total bearing of 4½ sq. ft., greatly exceeds the permissible safe bearing capacity of the soil. The footings for the piles must therefore be increased to safe limits. The concrete piles themselves have a safe load capacity of 600lb. per square inch, which is well above the load of approximately 2¾ tons each is required

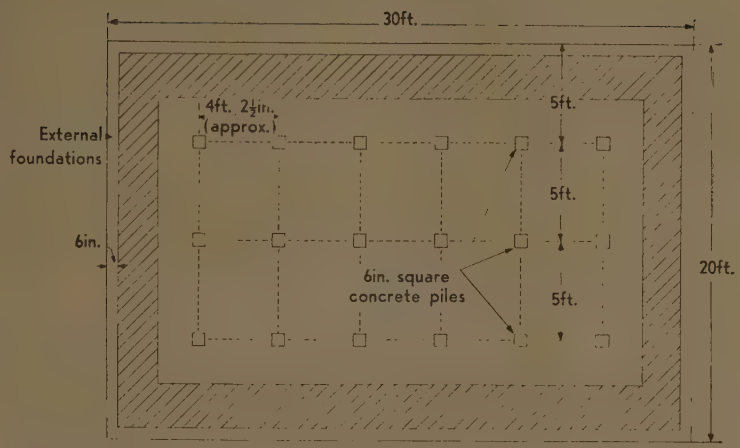

Fig. 5—Loading area of piles and foundation walls. The floor load on the area hatched is carried by the external foundations.

to carry. As the load-carrying capacity of the soil is 1½ tons per square foot, the pile footings must be increased to 2¾/1½ or approximately 2 sq. ft. in area, or say 18in. x 18in.

The above example is given in detail solely to illustrate the method of arriving at dimensions and ground areas of foundations. Some factors have been omitted, for example, in the calculation of the ground area required to support the building the weight of the foundations themselves must be considered.

Calculation for roof weight must also include live loads.

"The New Zealand Standard Code of Building By-laws" gives comprehensive particulars of minimum loads and stresses for use in designing buildings.

If in the building discussed above a concrete floor were placed directly on the ground, the building's foundations would become independent of floor loading both dead and alive, as they would have to carry the weight of the structure only. The floor-loading capacity would also be greatly increased, and would be approximately 900 tons evenly distributed over the whole area.

If the building were to be used for storage of any heavy machinery which would impose a greater load than 1½ tons per square foot over a confined or restricted area, this load could be distributed over the floor surrounding that area by correctly placed steel reinforcing, bringing the load per unit area to within the allowable limits.

Depth of Foundations

Even if the topsoil is capable of supporting the load of any proposed building over the area of normal foundations, it is not good practice to place foundations on topsoil. The ordinary range of climatic conditions is capable of altering the bearing power of the subsoil to a considerable depth. Long, continued frosts or droughts disintegrate soil and cause settlement of buildings with shallow foundations. This is most noticeable when the foundation is on clay.

Experience has shown that ordinary foundations on good soil are sufficiently deep if they are taken down to a level slightly below that to which the effects of climate penetrate. Where rock, dry gravel or sand, or dry, stiff clay is not reached at foundation level care must be taken that there is no danger of the ground alongside the foundation rising because the footing level is too shallow. Scouring by surface water must also be guarded against by the provision of suitable surface drainage.

On sloping sites back drainage with field tiles laid in gravel on a level with the bases of the footings may be necessary. This type of drainage prevents seepage dampness in basement walls.

The foundation trench must be excavated to the full width of the footings, and after these have been run the boxing for the reduced section for the remainder of the foundations can be erected.

If loose soil causes difficulty in obtaining clean-cut foundation trenches and prevents concrete being laid on solid ground, the sides of the excavation should be retained with planks and walings so that all "crumb" can be removed from the excavation before the concrete is laid.

With ground of uneven contour all foundations must be excavated level on the horizontal plane and should be stepped to suit the contour. Stepped foundations should be overlapped at steppings, as shown in Fig. 6.

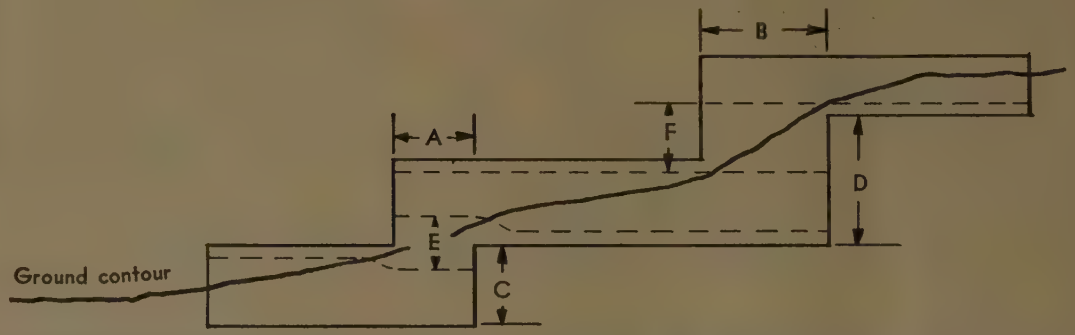

Fig. 6—Stepped foundation. The overlaps A and B are to be equal to the height of the steps C and D or 2ft., whichever is the less. The top and bottom reinforcing rods (E and F) are to be at least 9in. apart vertically at any one point.

Concrete footings for foundations may be plain or reinforced. Foundations not reinforced should be used only on hard ground where the soil-bearing capacity is uniform and continuous for the full length of the foundation. Where soil-bearing capacity varies over the length of the foundation suitably sized reinforcing should be placed where specified by the designer of the building. Where soil-bearing capacity is good and uniform footings for foundations should generally be not less in depth than two-thirds the thickness of the walls they support.

When excavation by cut and fill is carried out to obtain level ground for siting a building on a slope any foundations over the filled area must pass below the fill to virgin soil.

Compliance with By-laws

Every local body has its set of by-laws for building construction and before any building is begun the prospective builder should become acquainted with these by-laws to ensure that the proposed structure complies with the local body's requirements.

As the safety and stability of any building structure are the concern of the local body, these by-laws are very necessary to ensure these points and it is in the builder's own interests to comply with the by-laws as laid down.

Most local bodies base their by-laws on "The New Zealand Standard Code of Building By-laws" from which the following are extracts concerning foundations.

"915(a) Foundations shall consist of (i) continuous walls of brick, stone, or concrete which shall finish not less than 12in. above the ground level; or (ii) piers; or (iii) foundation blocks or piles: Provided that timber blocks shall not be used without the approval of the Engineer.

"916(a) (i) All foundations shall rest upon a solid and approved bottom, and, subject to the latter provisions of this subclause, shall extend at least 12in. below the adjacent ground.

"(ii) Piles under bearing walls shall be sunk to a depth equal to their projection above the ground, but not exceeding 18in., and shall have earth rammed and consolidated around them:—

"Provided that if in either case the Engineer is of the opinion that no advantage would result from strict adherence to the foregoing requirements, the depth to which foundations shall be sunk may with his approval be reduced to not less than 8in.

"(b) Piles shall not extend less than 6in. or more than 4ft. 6in. above the finished surface of the ground and they shall not be spaced at a greater distance than 4ft. 6in. centre to centre measured along the walls or sleeper-plates unless the plates are proportionately increased in section. A row of piles or dwarf walls shall be provided directly under the line of each main bearing partition, provided that in single-storey buildings such piles or wall may be distant not more than 1ft. from such line."

The Standard Code also specifies that "where the ground level is such that at more than one corner the bottom plate is more than 4ft. above ground continuous concrete foundation walls, suitably reinforced, shall be provided extending from each of such corners for a distance of not less than 4ft. 6in. along each adjacent wall" and if walings are required as mentioned below, provision shall be made for their attachment to the concrete.

The minimum reinforcing specified for these corner walls is "two rods each ½in. diameter carried right round the concrete corner panels within 2in. of the top, bottom, and ends, and in addition connected vertically at the corner by two ½in. rods hooked over the top and bottom rods."

Reinforcing for corner walls is shown in Fig. 7.

Where the safe ground carrying capacity is less than 1 ton per sq. ft. as for the first two soil types of Table 1 the Code recommends that "foundations shall be continuous concrete walls" with footings reinforced in accordance with Table 2 and top reinforcing as given below.

The tying together of opposite wall foundations for buildings of two storeys or more is recommended at approximately 16ft. intervals by "securely founded concrete walls not less than 6in. thick reinforced at top and bottom with one rod, of the same size as those in foundation walls, which shall be hooked over the rods in the outer walls.

"Reinforcing rods in external walls shall be bent round angles and all rods shall be hooked at the ends, lapped forty diameters, securely bound with not less than 16 S.W.G. black wire at joints, and laid perfectly straight.

"Where piles under external walls extend in the average more than 2ft. 6in. out of the ground the piles shall have longitudinal walings of not less than 4in. x 1½in. or equivalent section fixed on each side of them at 6in. above ground level."

Heart timber is recommended for these walings, which shall be "firmly attached to the piles by ½in. bolts if the piles are of concrete, brick, or stone, and by spikes if the piles are of timber. A brace not less than 3in. in thickness by the width of the plate shall be fixed between the walings and the plate in the space between the two end piles of each external wall. Similar walings and braces shall be inserted in rows of internal piles at approximately 16ft. intervals in each direction."

Outer walings are not required where base boards are 1½in. or more in thickness, where concrete piles which do not exceed 3ft. 6in. above ground are provided with footings 6in. deep by 18in. square cast integ-

rally with them, and where the spaces between brick, concrete, or stone piles are filled with brick or concrete panels with suitable footings and reinforcement and such panels are tied to the piles in an approved manner.

The Code specifies that the minimum thickness of brick or stone foundation walls for one- or two-storey buildings shall be 8½in., the walls being laid with approved bonding.

"Reinforced - concrete foundation walls for one-storey buildings shall be not less than 5in. thick and shall in addition to the reinforcement required in the footing be reinforced with not less than one ½in. rod at the top. For two- and three-storey buildings reinforced-concrete foundation walls shall be not less than 6in. thick and shall be reinforced with not less than one ⅝in. rod similarly placed. Where foundation walls are more than 3ft. in height above the footings the above-mentioned reinforcement shall be supplemented with ⅜in. rods at 15in. centre to centre vertically and horizontally."

Dimensions of Piles

The Code also gives dimensions of piles as follows:—

"Where piles are spaced at not more than 4ft. 6in. centre to centre in rows under walls or sleeper plates and the distance between rows centre to centre is not more than 7ft. the cross-sectional area of piles shall be not less than given [in Table 3].

"Where rows of piles are spaced at a greater distance than 7ft. centre to centre the piles shall be increased in sectional area by one-tenth for every 1ft. or part thereof in excess of 7ft.

"Properly laid brick or stone piles of equivalent area may be substituted for concrete piles, but their height above ground shall not exceed four times their least dimension.

"Concrete piles of a cross-sectional area of 64 sq. in. may be tapered from 8in. by 8in. at the bottom to 6in. by 6in. at the top provided that if they

TABLE 3—MINIMUM SIZES OF FOUNDATION BLOCKS OR PILES

Location of blocks or piles	Minimum sectional area	
	Timber sq. in.	Concrete sq. in.
Supporting outbuildings not exceeding 10ft. in height or 200 sq. ft. in area and lean-tos of the same dimensions attached to buildings	36	36
Supporting single - storey buildings or the lower floor only of two- or three-storey buildings	64	64
Supporting exterior walls and bearing partitions in two-storey buildings	100	100
Supporting bearing partitions in three-storey buildings	Not Permissible	144

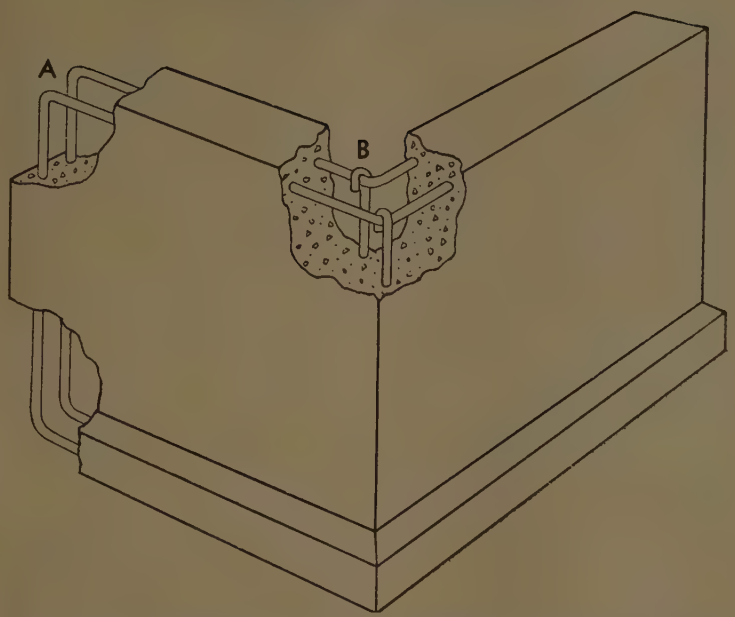

Fig. 7—Corner foundation cut away to show reinforcing. A—Two rods of at least ½in. diameter go right round the block and to within 2in. of the top, bottom, and ends. B—Two ½in. rods are hooked over the top and bottom rods.

are more than 2ft. 6in. long, they shall be reinforced throughout with a steel rod not less than ⅜in. in diameter.

"Where a greater sectional area than 64 sq. in. is required this may be supplied by increasing the area of the base or footing as shown in Fig. 5. Bases shall not be less in depth than 4in. or double the projection, whichever is the greater.

"Pre-cast piles may be used provided they are placed in concrete not less than 2in. greater in each dimension than the base of the pile and not less than 4in. deep before such concrete has set."

Foundation Finish and Ventilation

As the construction of the building must be carried on from the foundation upward, provision must be made by means of holding-down bolts and tie wires to fasten the plates firmly to the foundations. Bolts can be used in continuous wall foundations, but tie wires are more convenient for piles. The Code specifies:—

"Wall plates shall be secured by ½in. bolts bedded at least 6in. into the wall or by ⅝in. diameter steel dowels hooked at the ends and bedded at least 9in. into the wall; such dowels shall project 3in. above the plate and shall have their ends clinched over and stapled. Fixings shall be spaced at not more than 4ft. 6in. centre to centre, with not fewer than two fixings to each length of plate over 2ft. 6in. and with fixings not more than 15in. from each end thereof.

"Sleeper plates shall be similarly secured to concrete piles or alternatively by two strands of 8 S.W.G. galvanised wire looped and embedded at least 6in. into the concrete and extending a sufficient length above the concrete to fold over the plate and to be securely stapled. Sleeper plates shall be secured to timber piles by one 6in. nail driven through and two 4in. skew nails.

"Stringers shall be bolted to concrete or timber piles with ⅝in. bolts or alternatively if the pile is shouldered to provide a bearing for the stringer, the fixing may be ½in. bolts or in the case of timber piles one 6in. nail driven through and two 4in. skew nails."

Adequate ventilation is necessary under a building to ensure dry conditions which do not encourage decay. The Code states:—

"920. The space between bottoms of sleeper plates or stringers and the ground under any building shall be not less than 12in. at any point, and at no point shall there be any obstruction which will prevent ready access to all parts of the building for the purpose of inspection. There shall be provided a sufficient number of ventilating openings through foundation walls or exterior walls to ensure ample ventilation. The minimum requirements shall be ½ sq. in. of unobstructed air space per square foot of

FARM BUILDING . . .

ground floor area. This space may be provided by special ventilators evenly spaced at intervals of not more than 6ft. and commencing not more than 2ft. 6in. from each corner, or by continuous slots between base boards giving the same area of ventilating space. The special ventilators and the slots shall be placed as near as possible to the level of the wall plates and shall be made vermin proof. Where interior foundation walls exist they shall be pierced to allow adequate through ventilation, except in the case of party walls. The space under every building shall be so enclosed as to exclude all poultry and animals."

In building construction as in all construction the finished article is obtained by a series of processes or operations all of which dovetail into each other and must therefore be planned in detail. For example, on the foundations, the preparation of which is one operation, are placed the wall plates, which come in the next operation. However, fastenings for these plates must be included in the foundation operation, as they are cast in the concrete, but care must be taken in placing them that they do not interfere with work in the third operation of erecting studs on the plates. Nothing can upset a building programme more than the minor alterations which become necessary to rectify mistakes or oversight in planning. If a stud has to be moved a few inches to avoid a holding down bolt in a plate, it may result in a window having to be moved a corresponding amount, which in turn may mean at least uneconomical cutting of internal wall board or even more serious complications. It is in this thinking ahead that the amateur builder usually falls down. All operations from foundations to completed structure should be planned beforehand so that every small phase of the work dovetails.

Radio Broadcasts to Farmers

RADIO broadcasts to farmers will be given during May as follows:—

1XH Hamilton, 12.33 p.m.

13 May—"Care of the Ewe Flock", by G. R. Mackintosh, Livestock Instructor, Department of Agriculture, Hamilton.

20 May—"Plant Quarantine and Nursery Inspection", by A. H. S. Amos, Horticultural Inspector, Department of Agriculture, Hamilton.

27 May—"What the Future Holds for Farmers", by R. Woolerton, Federated Farmers, Hamilton.

1YA Auckland, 7.45 p.m.

1 May—"Water Hyacinth", by P. W. Smallfield, Director, Extension Division, Department of Agriculture, Wellington.

8 and 22 May—Talks by Animal Industry Division, Department of Agriculture.

15 May—"Soil Conservation Problems", by D. W. McLachlan, District Soil Conservator, Department of Agriculture, Auckland.

29 May—"Crops for Pigs", by B. A. Gunning, Instructor in Agriculture, Department of Agriculture, Matamata.

1YZ Rotorua, 7.15 p.m.

1 May—"Pasture Management during Winter", by B. A. Gunning, Instructor in Agriculture, Department of Agriculture, Matamata.

15 May—"Young Farmers' Clubs", talk by Rotorua district committee of Y.F.C. federation.

22 May—"The Preparation and Care of the Brood Sow and Her Litter in the Pumice Areas", by H. Preston, Supervisor, Rotorua District Pig Council.

29 May—"Trends in Milking Shed Design", by J. B. Cockerton, Special Inspector, Department of Agriculture, Hamilton.

2XA Wanganui, 8 p.m.

2 May—"For the Country Woman", by Mary MacDonald.

9 May—"The Radio Vet.", by S. Jamieson, Veterinarian, Department of Agriculture, Wanganui.

16 May—Talk, by C. M. Bailey, Supervisor, Taranaki District Pig Council.

23 May—"Shearing More than Once in One Year", by J. Ball, Sheep and Wool Instructor, Department of Agriculture, Wanganui.

30 May—"Preparing for the Chick Season", by B. J. Russell, Poultry Instructor, Department of Agriculture, Wanganui.

2YZ Napier, 7.10 p.m.

7 May—"Utilisation of Winter Feed Crops", by G. M. Bennett, Fields Instructor, Department of Agriculture, Hastings.

21 May—"Some Odd Facts on Wool", by P. C. Marshall, Sheep and Wool Instructor, Department of Agriculture, Hastings.

2ZA Palmerston North, 12.33 p.m.

6 May—"Care of Dry Dairy Stock", by D. R. Thomson, Livestock Instructor, Department of Agriculture, Palmerston North.

13 May—"Winter Management of Dairy Pastures", by B. A. J. Smith, Fields Instructor, Department of Agriculture, Palmerston North.

20 May—"Diseases of Strawberries", by T. N. Flint, Plant Quarantine Officer, Department of Agriculture, Palmerston North.

27 May—"Seed Purchase", by A. V. Lithgow, Officer in Charge, Department of Agriculture s Seed-testing Station, Palmerston North.

3YA Christchurch, 12.20 p.m.

6 May—"High Country Development", by L. C. Bascand, Instructor in Agriculture, Department of Agriculture, Christchurch.

20 May—Review of "The New Zealand Journal of Agriculture", by E. G. Smith, Instructor in Agriculture, Department of Agriculture, Rangiora.

4YA Dunedin and 4YZ Invercargill, 12.33 p.m.

6 May—"New Poisons for Rabbit Destruction", by J. P. Shennan, Assistant Livestock Superintendent, Department of Agriculture, Dunedin.

4YZ Invercargill (following joint programme from 4YA and 4YZ)

6 May—"Fencing", by A. R. Rankin, Fields Instructor, Department of Agriculture, Invercargill.

Regular Sessions

1XH Hamilton, Mondays at 12.33 p.m. and Tuesdays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (stock sale review).

1XN Whangarei, Mondays at 8 p.m. (Northland livestock report and "Farming for Profit"), Wednesdays at 8 p.m. ("Farming for Profit"), and Fridays at 8 p.m. ("News for the Farmer").

1YA Auckland, Mondays at 12.33 p.m., Tuesdays, Wednesdays, and Thursdays at 7.45 p.m., and Fridays at 6 p.m. and 7.45 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock market review), Tuesdays at 7 p.m. (Hamilton stock market report), Wednesdays at 7 p.m. (Bay of Plenty country journal, Pig Council talk on fourth Wednesday of every other month at 12.33 p.m.), Thursdays at 12.33 p.m. (news for the farmer).

2XA Wanganui, Wednesdays at 8 p.m. (Wanganui stock sale report), Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m., Fridays at 8.2 p.m. (Gisborne stock market report).

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8.1 p.m.

2YA Wellington, Mondays at 7.15 p.m. Thursdays at 12.33 p.m., Fridays at 7 p.m. (Feilding stock market report).

2YZ Napier, Tuesdays at 12.12 p.m. (Hawke's Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m. (Hawke's Bay-Poverty Bay livestock market report), Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m. (Feilding stock market report).

3XC Timaru, Mondays at 8 p.m. (Pleasant Point stock market report), Tuesdays (fortnightly) at 8 p.m. (Temuka stock market report), Wednesdays at 8 p.m., and Saturdays at 10.30 a.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m. (Addington stock market report), Thursdays at 12.33 p.m. and 7.15 p.m.

3YZ Greymouth, Mondays and Thursdays at 12.33 p.m.

4YA Dunedin, Mondays at 12.33 p.m., Wednesdays at 7 p.m. (Burnside stock market report), Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m., Tuesdays at 7 p.m.

COMMONWEALTH ECONOMIC COMMITTEE

Publications of the Committee include:—

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A Review of Commonwealth Agriculture: Production and Trade (1952). 7s. 6d. (7s. 11d.)

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Canned Food (1955). 5s. (5s. 5d.)

Commonwealth Trade, 1955-56. 2s. (2s. 2d.)

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Winter Show Dates

15, 16, 17, and 18 May—Whakatane A. and P. at Whakatane.

*28, 29, 30, and 31 May, 1, 3, and 4 June—Waikato Winter Show at Hamilton.

*30 and 31 May, 1, 3, and 4 June—Otago A. and P. at Dunedin.

*12, 13, 14, and 15 June—Taranaki A. and P. at New Plymouth.

13, 14, and 15 June—Te Kuiti and District Winter Show at Te Kuiti.

25, 26, 27, 28, and 29 June—Whangarei A. and P. Winter Exhibition at Whangarei.

* The Department of Agriculture exhibit will be staged at this show.

Making Circular Skirts

By MARY HUNT,
Field Officer in Rural Sociology,
Department of Agriculture, Christchurch

HALF-CIRCLE skirts are perhaps worn considerably more for everyday wear than full-circle skirts. The full circle can, however, look extremely attractive, especially for evening wear, whether it is short, ballerina length, or full length. For those who make their own clothes draughting the patterns for full-circle or half-circle skirts is very simple, and the procedures in making these patterns and the garments are outlined in this article.

A Full-circle Skirt

A FULL-CIRCLE skirt is made up of four quarter circles or two half circles.

By use of a large piece of paper a right angle is drawn as at A in Fig. 1. The waistline can be fixed by making AB 1/6 of the total waist measurement (that is, if waist measurement is 24in., AB will be 4in.). AC is the same as AB. Draw in the waistline CB by pivoting from A.

BD is the required skirt length, plus the hem allowance, which should be added to the pattern. CE is the same as BD. The hemline ED is drawn in the same way as the waistline by pivoting from A.

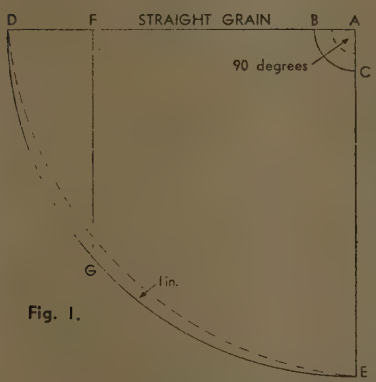


Fig. 1.

A large compass is not readily available in most homes, but a pin, a piece of string, and a pencil can be substituted. The pin is used as a pivot and the pencil is held the required distance apart by the string, which is tied firmly to the pin and the pencil at each end. Alternatively the waistline and hemline can be marked in by using a tape measure. By measuring from A the required length can be marked in at intervals with a pencil. The pencil marks can then be connected up.

The centre of the hemline will fall on the true bias and will drop more than the sides when being worn, so the centre will need to be raised 1in. as shown by the dotted line in Fig. 1. It is always advisable to hang a circular skirt for several days before turning up the hem to make sure it will not drop further.

Cutting the Material

If the width of the material and the pattern are suitable, it is sometimes possible to lay one side of the pattern on the fold of the material. This will eliminate the centre front and centre back seams and the skirt will be made up of two half circles, whereas the skirt would otherwise be cut as four quarter circles.

To ensure that the skirt will hang correctly lay the sides of the pattern on the straight grain of the material. Seam allowances must be added when cutting.

Pieces may have to be joined on to the skirt, especially for a ballerina-length or full-length skirt, and these pieces must be joined on the straight grain by cutting from the hemline to the side seam in the way shown by the line GF in Fig. 1.

A Half-circle Skirt

A half-circle skirt is made up of two quarter circles.

The pattern is drawn in a similar way to the full circle, except that the waist measurement must be doubled. A right angle is drawn as at A in Fig. 2. The waistline can be located by making AB one-third of the total waist measurement (that is, if the waist measurement is 24in., AB will be 8in.). AC is the same as AB.

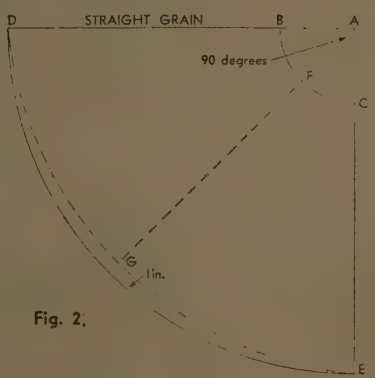


Fig. 2.

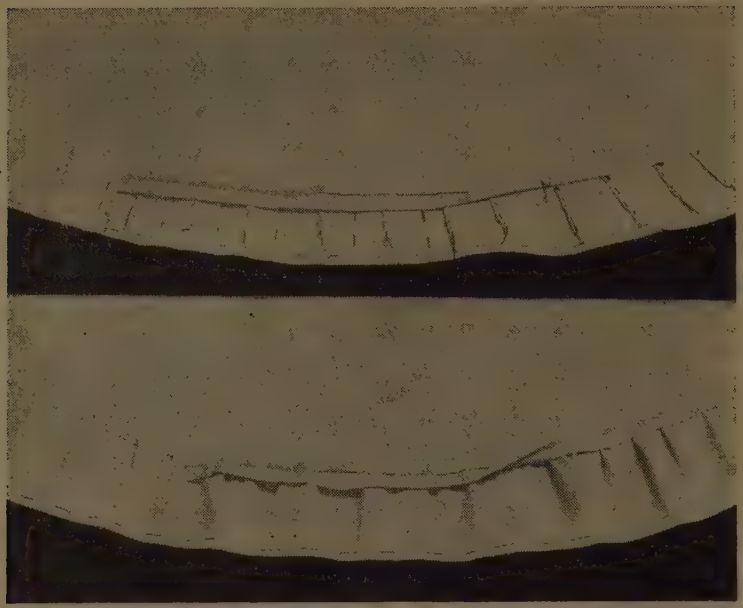
CE and BD are the required skirt length, plus the hem allowance. The waistline and the hemline are drawn in in the same way as for a full circle. The centre will also need to be raised on the half circle to allow for drop on the bias.

The pattern can be used as a four-gore skirt by cutting it up the centre as shown by the dotted line FG. If this is done, the seam allowance will need to be added for the join.

Cutting the Material

The pattern is cut out in the same way as the full circle, except that only two quarter circles are needed unless a four-gore skirt is required.

The side seams must be laid on the straight grain of the material and seam



The fullness in a circular hem can be taken out by forming small pleats as shown in the upper illustration. An alternative method is to ease it out with a basting thread as shown in the lower illustration.

allowances must be added when cutting.

A Gathered Circular Skirt

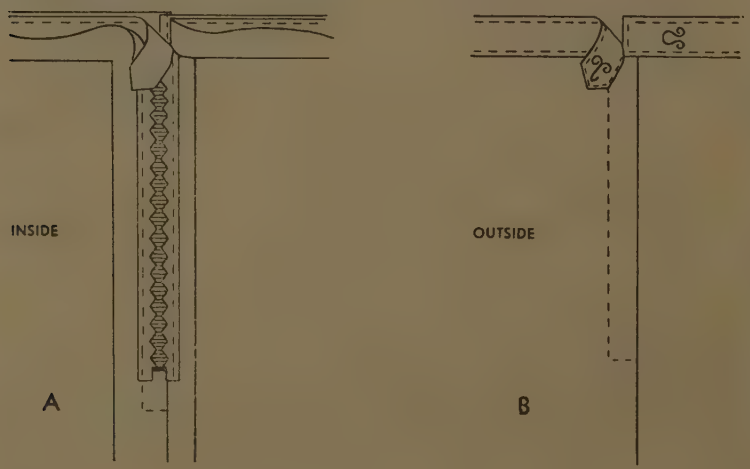
If gathers or pleats are required on a full-circle skirt, the waist measurement must be increased. This can be done by lowering the waistline, which would mean increasing the measurement from A to B in Fig. 1. The amount of increase will depend on the amount of gathering required. If the waist measurement is to be doubled, the pattern will be exactly the same as for the half-circle skirt. Four pieces will still need to be cut to make up the full circle.

Sewing the Skirt

If pieces have to be joined to the skirt, it must be done first, and the seams pressed open. The main seams can then be sewn and finished leaving sufficient for a placket on the left side. These seams should also be pressed open.

The placket should then be finished off and domes, hooks, or a slide fastener attached and the waistband can then be sewn on.

Fig. 3—Method of attaching the waistband to a circular skirt.



The Waistband

Cut the waistband the length of the waistline plus sufficient for an overlap and seam allowance and twice the required finished width plus seam allowances. The material is folded in halves lengthwise and the ends stitched with the right sides together. A stiff interlining is sometimes advisable, especially for light-weight fabrics. The waistband is sewn to the skirt waistline by sewing the back edge to the wrong side of the skirt (Fig. 3 A) and then turning under the seam allowance on the front edge and machine stitching on the outside (Fig. 3 B). A more finished appearance can be obtained if the top of the waistband is also stitched on the outside.

The Hem

The depth of the hem will depend on whether or not the garment may need to be let down at a future date. If the material is very thick, the hem should be as narrow as possible to avoid bulk.

As a circular skirt lengthens the circumference increases, so the edge of the hem will be wider than the fold. Thus there will be a considerable amount of fullness to be taken out in the form of pleats or gathers. For thick material it is best to form small pleats.

The hem should be turned up and tacked into place the stitches being kept very near the fold. The garment should then be laid flat on the table and the hem smoothed up to form little pleats, care being taken that they do not reach right to the fold or points will be formed round the bottom of the hem. Pins should be placed vertically between each pleat and the pleats tacked into position on the hem but not right through to the outside of the garment. To avoid bulk the best method of sewing up the hem is with bias binding or tape and machine stitching one side of the binding to the hem edge and slip stitching the other edge into position.

An alternative method of turning up a circular hem is to machine baste or hand baste about ¼in. from the raw edge and then to draw up the thread until the fullness has been eased out sufficiently. It should be distributed evenly so that the bottom edge of the hem will lie smoothly. Binding can then be sewn on and slip stitched into place.

Photographs by Standish and Preece.

Modernising a Farmhouse Kitchen

By EVELYN E. MOORE,
formerly Field Officer in Rural Sociology,
Department of Agriculture,
Palmerston North

MOST older farmhouse kitchens show little evidence of any thought and planning in either the over-all house plan to make the most of morning sunshine or a pleasant view or in the organisation of equipment in the kitchen, yet much can often be done to improve the most unpromising kitchens, sometimes even without the expenditure of much money, though expenditure, of course, depends on the type and extent of alterations necessary. Each kitchen to be remodelled is an individual problem, but kitchens which have proved to be convenient after being remodelled may provide ideas for others who wish to remodel inconvenient kitchens. In the May 1956 "Journal of Agriculture" the remodelling of three farm kitchens are discussed, and in this article the remodelling of another farm kitchen is described.

THOUGH the original kitchen measured about 11ft. 8in. x 7ft. 6in., it contained very few cupboards and

The setting for the dining table is attractive with both a view and morning sunshine.

▼ The working area of the replanned kitchen. The cupboards, drawers, and shelves are planned for efficient storage.

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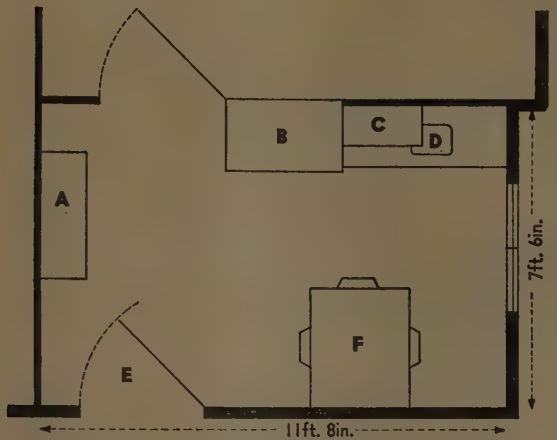


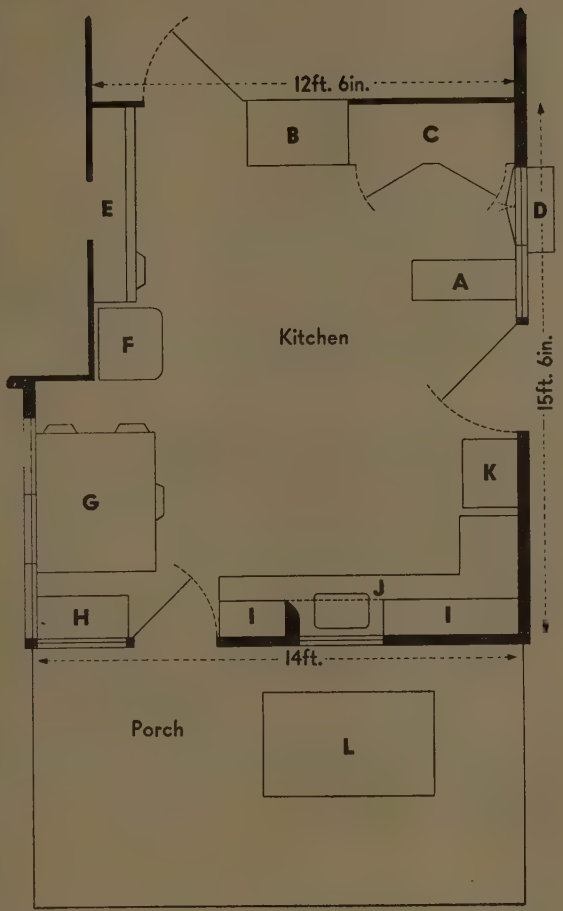
Plan of original kitchen: A—Bins, with drawers above. B—Fuel stove. C—Cupboard. D—Sink. E—Back door. F—Table.

a very inadequate area of bench space. A pot cupboard under the sink and a small cupboard over the sink bench, which was next to the coal stove, was all the storage space available, and the sink bench was not even 5ft. long (see plan above).

There was no pantry, additional storage space being provided by an outside dairy some distance from the back door. The purchase of a set of three bins with drawers above helped a little, but storage space remained inadequate. A small kitchen table barely large enough for the family and most inconvenient when farm workers and others were present at meals occupied most of the remaining space. In this house the dining room was inconveniently situated in relation to the kitchen. In addition, though the kitchen faced north-east, the windows were on the wall where the view and sunshine were blocked by the nearby dairy and other buildings.

For remodelling it was decided to concentrate on three factors: First, to extend greatly the size of the kitchen to provide ample indoor storage for all food supplies and kitchen utensils; secondly, to provide pleasant and ample eating space in the kitchen not only for the family but for all farm workers and visitors; thirdly, to get the greatest benefit possible from the morning sunshine and the pleasant view obtainable over the garden and farm.

A desirable feature of the old kitchen which it was decided to retain was the wood stove, which was comparatively new. It is lit every morning and is used not only for cooking breakfast and for supplementary water heating, but for providing warmth on chilly mornings and throughout winter. Ample supplies of wood are available on the farm, and this was another consideration for its retention.



Plan of remodelled kitchen and dining porch: A—Bins, with drawers above. B—Fuel stove. C—Linen storage, etc. D—Wood cupboard. E—Supplementary storage, hatch to dining room, and telephone. F—Refrigerator. G—Table. H—Seat and cupboard for ironer. I—Cupboards above sink. J—Sink bench. K—Electric stove. L—Porch dining table.

Enlargement of Kitchen

The kitchen was increased in size by the addition of an area 8ft. x 14ft. and extension of the outside wall (containing the window), which was originally recessed slightly to make it flush with the rest of the outside wall. This made the older portion of

The outdoor porch and dining table. →

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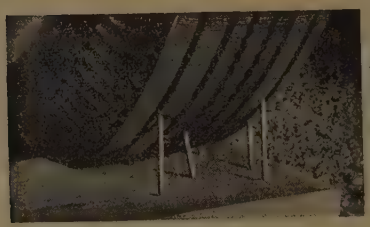

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2 of the NEW Academy Patterns

The fuel stove retained from the original kitchen, the supplementary storage cupboards, the serving hatch to the dining room, and the refrigerator. The bench is conveniently low for writing and telephoning.

the kitchen 12ft. 6in. long and the newer portion 14ft., and the width was increased from 7ft. 6in. to 15ft. 6in., making the kitchen almost square (see plan). At the same time a wide porch was built on to be used for relaxation and for meals in summer. The porch extends across the full width of the wall which faces north (see plan) and is 8ft. 6in. deep.

The old, inadequate sink bench was removed and replaced by a large hot water cupboard extending from the wood stove to the outside wall and providing ample space for airing, drying, and storing clothes, linen, etc. A wood box, designed for easy access from both inside and outside the house, was built into the corner under the window, and near the stove the set of bins, which was retained, as it was in excellent order, was placed at right angles to the wall near the additional outside door in the new plan. In this position it provides bench space close to the wood stove and is also close to the newly installed electric stove.

Economical planning of shelf space is evident in the cupboards over the sink bench.

The wood cupboard, which is accessible from inside and outside, and the set of bins. The drawers contain recipe books.

Another outside door was made in the wall near the wood stove to give direct access to the outbuildings, and this is much more convenient for access to the garage and car parking space.

Stove, Sink, and Bench

A compact, L-shaped working unit of stove, sink and sink bench (with recessed toe space at the bottom), and cupboards was planned to fill two adjacent walls of the new extension (see the right-hand plan on page 405 and the lower illustration on page 403). Cupboard shelves were designed for maximum use of the space available and provide ample storage for food and everyday china, cutlery, and kitchen utensils. Storage was provided for baking supplies and utensils near the stove and for table ware near the dining table. Cupboards under the sink bench allow easier access to such light equipment as the dish drainer and pot lids. The electric mixer was conveniently sited in the corner of the bench, where it was not in the way and yet was easily accessible. Adequate electric points were conveniently placed. To the right of the sink bench was placed a narrow cupboard to hold the kitchen scrap tin, and drawers to hold cutlery, tea towels, table linen, aprons, and hand towels, with a larger drawer for bread at the bottom.

The sink bench (40in. high) was made higher than is usual for the greater convenience of the housewife, who is tall. This has made available more under-bench storage space, which has been used to good advantage. The glass door to the right of the sink bench provides easy access for outdoor meals on the porch.

More storage space is provided by new cupboards on the wall to the left of the wood stove. A table-high bench is convenient for writing and telephoning and for holding the farm telephone and automatic telephone, note books, and pencils, which are readily at hand.

Above this bench shallow cupboards are used for storing less frequently used articles and good china. A recess to hold the radio is also built into this section, and underneath this is a serving hatch to the dining room, which greatly facilitates the serving of occasional meals there, though most meals are eaten in the kitchen. Previously there was no such convenience.

Next to this bench is the refrigerator, which is centrally situated, though it may not be quite so conveniently placed in relation to other equipment as may have been possible in a new kitchen.

The large dining table is in the slightly recessed bay which faces approximately north-east and gives an expansive view over the garden toward the distant hills. The table can be pulled out to seat eight. A small built-in seat at one end of the table holds the ironer.

These are the main features in this remodelled kitchen, which is finished in a cheerful colour scheme and provides yet another example of what can be done with dingy and inconvenient kitchens not only to make them attractive, convenient, and labour saving for the housewife, but also to provide much pleasanter settings for meals and family living generally.

Washing White Woollens

THE dainty appearance and soft feel of hand-knitted white woollens are so appealing that at the time of purchase one is apt to forget that they will require frequent washing, and that this must be done with extra care if the garments are to retain their original qualities.

Rubbing, alkaline and hot washing solutions, and hard water are the chief causes of bad results in washing. Though most knitting wools are treated for shrink resistance, hard washing and rubbing will still cause felting. It is better to wash the garments before they become heavily soiled; little and often suits them better than an occasional heavy treatment.

Soft water is essential; in hard water areas rain water should be used or the tap water softened. With hard water, soap forms a scum which is almost impossible to rinse out thoroughly and which imparts an off-white colour and a harsh feel to the wool. Washing should be done by squeezing, and rubbing should be avoided. Very thorough rinsing in water that is the same temperature as the washing water is necessary.

Wringing by twisting must be avoided. The garment should be placed in a towel and put through the wringer several times, and then set to its original shape on a flat-rack or table and allowed to become nearly dry away from any source of heat.

When nearly dry it can be hung up with the weight evenly distributed. It should not be dried in the sun, because sunlight scorches wool and produces an undesirable yellowish colour in woollens that are meant to be white.

—MAUD B. STRAIN,
Field Officer in Rural Sociology, Department of Agriculture, Dunedin

Principles and Methods of Food Preservation

WHEN the factors involved in the preservation of food are understood and the necessary precautions are taken the results can be gratifying to the housewife.

In Bulletin No. 391, "Principles and Methods of Food Preservation", a new publication by the Department of Agriculture, the causes of food spoilage and methods of preventing it are described and instructions are given for bottling fruit and vegetables and for jam and jelly making.

The bulletin may be obtained free from any office of the Department of Agriculture.

Trees in New Zealand Gardens

MANY home gardens on which are lavished a great deal of time and care comprise a lawn, flower beds, and possibly several shrubs. Though neat and attractive in a restricted sense, they are lacking in the interest and character which could be given by a few well-chosen and carefully sited trees of suitable size and form. The height and spread of selected trees can add beauty to what may be a comparatively uninteresting section and home, and at the same time give shelter from wind and shade from summer sun. In this article J. S. Say, Horticulturist, Department of Agriculture, Auckland, gives information on the use of trees, discusses factors to be considered when selecting them, and provides a chart setting out the main characteristics of many trees as a guide in the choice of those suitable for various sites and climates. The notes on work in the flower garden in May are by Elspeth Gray, Horticultural Instructor, Department of Agriculture, Auckland.

THE attractive appearance and the pleasing effect of privacy of many New Zealand home gardens have seldom been achieved by haphazard planting; the whole layout has been planned, but the trees especially have been chosen with great care, for their part in the garden is both prominent and permanent.

The numerous examples of less attractive and often definitely unsuitable uses of trees are the results of thoughtlessness or lack of knowledge. Many of the pitfalls can be avoided by giving consideration to the following points and then planting trees which, when fully grown, will have size and habits of growth suitable for the situations in which they have been placed.

1. What is the purpose of each tree? Is it for shade, shelter from wind, background for other plants, or is it needed to break an uninteresting skyline or block an undesirable view?
2. The next step is to decide on the type, height, spread, and shape when fully grown. Should foliage be light or dense, and would an evergreen or deciduous tree be more suitable? Is the foliage colour important?

There are many attractive flowering → trees in the genus *Prunus*. They vary in flowering time, height, and habit of growth. Care should be taken to select the most suitable type for the garden. Upper—The flowering cherry plum (*P. blireana*) is slightly spreading. Elliott photo. Lower—The double flowering cherry Kanzan is more upright in growth. Elliott photo. Inset—Some double flowering cherries like Mount Fuji are spreading in habit. McGregor photo.

[*Willski*

The kowhai makes an attractive tree and will flourish in poor soil.

3. Then check whether the chosen tree is suited to the soil and climate of the section and locality. A look at established trees in the neighbourhood will help, but advice should be asked from anyone with a knowledge of trees in the district. The following notes and the chart on pages 412-415 are intended to help in the making of a selection. If the first choice is unlikely to thrive, it should be discarded in favour of a similar kind of tree better suited to the conditions.

Uses in the Garden

Being long lived, trees have a permanent effect on the landscape and one of their greatest uses is to give the impression of permanence and maturity to a house and garden. A house without trees about it never seems to merge into the landscape no matter how old it is, yet on the other hand a house of contemporary design looks as if it belongs to the section in a surprisingly short time if suitable trees are planted.

For blocking out unpleasant views and for screening the private part of the garden from the street trees are ideal. Their use in breaking the force of the wind is well known, but it is not generally recognised that they have the effect of filtering out a considerable amount of dust in areas of unsealed roads, and they also deaden traffic and other noises.

A shade tree is invaluable in summer if the garden is to be used to its fullest extent, and there are few gardens, even on small town sections, where room cannot be found for one. A tree carefully placed to shade the living rooms of the house in summer will reduce the temperature by several degrees and will also lessen the glare. A garden with trees gives the impression of coolness in summer and is, in fact, generally cooler.

Ornamental trees can serve many useful purposes. A good specimen tree can be the focal point, and a group can be used as a background. If a wider view of the landscape in general is taken, trees give an irregular skyline in level country.

They provide many ways of introducing colour into the garden and even the coldest districts need not be dull in winter, for there are a large number of hardy conifers with yellow, gold, bronze, and blue-grey foliage; also many deciduous trees have attractively coloured bark. Flowering plums, cherries, apples, and magnolias brighten the spring garden, and these and other deciduous trees provide brilliant colour in autumn. Apart from the conifers already mentioned, there are other trees, both evergreen and deciduous, with coloured and variegated leaves which can be used.

With care and forethought, beauty and utility can easily be combined; and, especially on small sections, trees which serve more than one purpose should be chosen.

Types of Trees

Trees are often divided into three groups, deciduous, evergreen, and conifer. Though the individual trees in each group differ, the groups as a whole have certain definite characteristics and consequently have particular uses in the garden and in the landscape.

Deciduous trees are attractive because of their ever-changing leaves, from the soft, pale green of spring, through the darker greens of summer, to the browns and golds of autumn. In winter they provide an interesting pattern of twigs and branches and many have bark with attractive colours and textures. Most of the spring flowering trees belong to this group. Deciduous trees are particularly useful for planting where winter shade is undesirable or where bright autumn colour is needed.

Evergreens have a permanent effect throughout the year and change little through the seasons, but depend on their shape and the colour, texture, and pattens of the leaves for their attractiveness.

Conifers have a strong effect all the year round because of their solid mass. Though colours vary in different species from dark, sombre greens and greys to bright golds and yellows, there is little seasonal variation. They need more careful placing in the garden than the other types and are best used for background planting or as specimen trees where a strong accent is needed.

Height and Spread

Trees vary in height from 15ft. or 20ft. to forest giants of 80ft. or more, but this is frequently overlooked by home gardeners when selecting them. Probably the most common mistake in tree planting is the choice of trees which soon outgrow the space available and have to be mutilated because they are touching the overhead wires, overhanging the path, or blocking out the sun and view. It is always wise to find out the mature height and spread of a tree before planting it, and if there is any likelihood of it outgrowing its position, a smaller tree should be used instead.

Gardeners often try to justify the planting of larger trees by saying that if they grow too big, they can be taken out. In practice this rarely happens and the tree is simply chopped back or trimmed to an unnatural shape which bears little resemblance to the true characteristics of the species. Even if the trees are removed, the resulting gap may take many years to fill. All this work and delay could have been avoided if suitable varieties had been planted in the first place.

The size of the tree in relation to the house and section should also be taken into account. Large trees can dominate small houses and sections and make them look smaller, and small trees about a large house can look equally out of place.

Shape

Shapes vary; they may be columns, cones, inverted cones, spheres, and hemispheres (umbrella shapes). By the selection of definite shapes, various effects can be obtained in the garden. Columnar trees accent vertical lines and tend to lead the eye upward. They should be used only where these effects are wanted. Frequently they are wrongly used with tall, narrow houses and when planted near the corners can look particularly out of place. A rounder, spreading type planted to the sides of such houses has the effect of making the base appear wider and more in proportion to the height. Too many columnar trees in a garden can have a disturbing effect like exclamation marks in a line of print.

Trees should always be allowed to grow naturally, for once they are trimmed they lose their character. If, for example, a round, compact tree is wanted, one with these characteristics should be chosen and an open, spreading tree should not be forced to conform by drastic trimming. Pruning, which will be discussed later, should be done only to assist the tree to assume its natural shape.

Growth Habit

Growth habit varies a great deal in each size and shape group. For example, a tree with a large hemispherical head may have wide spreading branches like an oak or a weeping habit like a willow. Trees may be light and open or dense and compact; leaves in a wide range of colours may be large or small and can give the effect of coarse or light textures. These are only some of a host of characteristics which give trees individuality.

A knowledge of growth habit, size, and shape can be used to give very interesting and attractive effects. Bold foliage and coarse texture often look well when used in conjunction with contemporary-style houses, but would look too heavy and stolid when used with a traditional brick house. By the use of various contrasts interesting effects can be obtained in group planting.

Where groups of mixed trees are planted as screens or for protection against wind they should be given room to develop fairly fully before they touch. In this way the individuals will retain characteris-

Idesia polycarpa makes a handsome specimen deciduous tree which bears large clusters of berries. Male and female trees are needed for cross-pollination. This tree has been correctly sited, by setting against a background of conifers, to show the tree to the best advantage.

tics, yet the group as a whole will have an entity of its own. Suitable varieties such as silver birch are frequently planted close together and as they grow they assume the habit of a single specimen. This is a method to give a quick effect, but varieties must be selected with care.

Root systems should also be considered. Some trees have roots which become a nuisance by blocking drains or by damaging paths and house foundations. If the trees are to be underplanted with shrubs or lawn, species with deep roots and a light, open top growth should be chosen. Deciduous trees are sometimes best, because they do not unduly shade the ground in winter.

Soil and Climate

Though the majority of trees will grow well on most garden soils, others require particular conditions. A know-

The native karaka (*Corynocarpus laevigata*) is a round-headed evergreen tree suitable for coastal planting.

ledge of these requirements will make it possible to select the most suitable tree for the position, for though in some cases it may be possible to alter the conditions to suit the tree, this is not generally practicable.

Frost-tender trees are obviously not suitable for cold climates, but the converse is often not considered. Many trees native to cold regions are not

Type	Leaves: Coloured	Leaves: Variegated	Leaves: Autumn colour	Flowers: Spring	Flowers: Summer	Flowers: Autumn	Flowers: Winter	Fruit: Summer	Fruit: Autumn	Fruit: Winter	Habit: Upright	Habit: Spreading	Height: Up to 20ft.	Height: 20ft. to 30ft.	Height: 30ft. to 50ft.	Height: Over 50ft.	Name	Hardiness: Hardy	Hardiness: Half-hardy	Hardiness: Frost tender	Hardiness: Wind resistant	Hardiness: Salt resistant	Hardiness: Shelter when young	Soil: Average	Soil: Continuously wet	Soil: Dry	Soil: Light or sandy	Uses: Specimen	Uses: Shade	Uses: Shelter belts	Uses: Tubs	Uses: Screens, shrub borders
C											☆				☆		*Abies* nobilis* (noble fir)	☆						☆				☆			☆	
C											☆					☆	*A. nordmanniana* (Caucasian fir)	☆						☆				☆			☆	
C											☆				☆		*A. pinsapo* (Spanish fir)	☆						☆				☆			☆	
E	☆			☆								☆	☆				*Acacia* baileyana* (Cootamundra wattle) ..		☆			☆		☆		☆	☆	☆				☆
E	☆			☆								☆	☆				*A. podalyriaefolia* (Mt. Morgan wattle) ..		☆			☆		☆		☆	☆	☆				☆
D			☆									☆					*Acer* campestre* (field maple)	☆						☆				☆	☆			
D		†	☆									☆		†	☆		*A. negundo*† (box elder)	☆					☆	☆		☆		☆	☆			†
D	†	†	☆									☆	†	☆			*A. palmatum*† (Japanese maple) ..	☆					☆	☆		☆		☆	☆		☆	†
D	†		☆									☆		†	☆		*A. platanoides*† (Norway maple)	☆						☆		☆		☆	☆			
D	†	†	☆									☆		†	☆		*A. pseudoplatanus*† (sycamore)	☆				☆		☆		☆		☆	☆			
E								☆	☆			☆		☆			*Acmena floribunda* (*Eugenia smithi*) monkey apple															
C											☆					☆	*Agathis australis* (N.Z. kauri)	☆				☆	☆	☆				☆	☆		☆	
D												☆			☆		*Ailanthus glandulosa* (tree of heaven) ..	☆						☆		☆		☆	☆			
E								☆	☆			☆			☆		*Alectryon excelsum* (N.Z. titoki)		☆		☆	☆		☆				☆	☆			☆
C											☆					☆	*Araucaria cunninghami* (Moreton Bay pine)		☆		☆	☆		☆				☆				
C											☆					☆	*A. excelsa* (Norfolk Is. pine)		☆		☆	☆		☆		☆	☆	☆			☆	
C											☆					☆	*A. imbricata* (monkey puzzle)	☆						☆				☆				
E									☆			☆		☆			*Arbutus* unedo* (strawberry tree)	☆				☆	☆	☆		☆	☆	☆				☆
E	☆			☆					☆			☆	☆				*Aristotelia racemosa* (N.Z. makomako, wineberry)	☆						☆				☆				☆
D				☆					☆			☆			☆		*Aesculus carnea* (red horse chestnut) ..	☆						☆		☆		☆	☆			
D				☆					☆			☆				☆	*A. hippocastanum* (horse chestnut)	☆						☆		☆		☆	☆			
E												☆	☆				*Albizzia lophantha*		☆					☆	☆					☆		
E				☆								☆	☆				*Azara* microphylla*	☆					☆	☆								☆
D			☆								☆				☆		*Betula* alba* (silver birch)	☆						☆	☆	☆		☆	☆		☆	☆
E												☆			☆		*Beilschmedia tarairе* (N.Z. tarairе) ..		☆													
E										☆		☆			☆		*B. tawa* (N.Z. tawa)		☆													
E				☆								☆			☆		*Brassaia actinophylla* (umbrella tree) ..			☆			☆						☆		☆	
D									☆						☆		*Castanea sativa* (Spanish chestnut) ..	☆						☆				☆	☆			
E												☆			☆		*Casuarina* cunninghamiana* (she-oak) ..	☆				☆	☆			☆			☆			
E												☆			☆		*C. glauca* (swamp she-oak)	☆				☆	☆						☆			
D		†			☆							☆		†	☆		*Catalpa bignonioides*† (Indian bean tree) ..	☆							☆			☆	☆			
E				☆								☆		☆			*Carpodetus serratus* (N.Z. putaputaweta) ..	☆						☆								☆
C												☆		☆			*Callitris* glauca* (Murray River pine) ..		☆			☆	☆			☆	☆		☆	☆		
C	†											☆			☆		*Cedrus* atlantica*† (atlas cedar)	☆						☆					☆			
C	†											☆			☆		*C. deodara*† (deodar)	☆						☆					☆			
D				☆					☆			☆			☆		*Cercis siliquastrum* (Judas tree)	☆				☆		☆		☆						☆
E	☆											☆			☆		*Cinnamomum camphora* (camphor laurel) ..		☆			☆	☆			☆		☆	☆	☆	☆	☆
E										☆		☆	☆				*Citrus* var. (oranges, lemons, etc.)			☆				☆								
C	†	†										☆	☆	☆			*Chamaecyparis* lawsoniana*† (Lawson's cypress)	☆						☆				☆	☆	☆	☆	
C	†											☆	☆				*C. obtusa*†	☆						☆				☆	☆	☆	☆	
C	†											☆	☆				*C. pisifera*†	☆						☆				☆	☆	☆	☆	
C	†											☆	☆				*C. thyoides*†	☆						☆				☆	☆	☆	☆	
E					☆				☆	☆		☆		☆			*Cornus capitata* (strawberry tree) ..		☆									☆				
D			☆	☆								☆	☆				*C. controversa, C. florida* (dogwood) ..	☆						☆								☆
D			☆	☆								☆		☆			*C. kousa*	☆						☆								☆
E	†			☆								☆		☆			*Cordyline australis*† (N.Z. cabbage tree) ..	☆				☆	☆		☆					☆		
E	†	†							☆			☆		†	☆		*Corynocarpus laevigata*† (N.Z. karaka) ..		☆			☆	☆									
C	†											☆		†	☆		*Cryptomeria japonica*† (Japanese cedar) ..	☆				☆	☆						☆	☆	†	
C	☆											☆			☆		*Cupressus* arizonica*	☆				☆	☆			☆		☆	☆	☆		
C												☆			☆		*C. lusitanica*	☆				☆							☆	☆		
C	†											☆	†		☆		*C. macrocarpa*†	☆				☆	☆			☆		†	☆	†		
C											☆			☆			*C. sempervirens stricta* (Italian cypress) ..	☆						☆		☆			☆	☆		
C											☆				☆		*C. torulosa* (Bhutan cypress)	☆						☆					☆	☆		
C											☆				☆		*Dacrydium* cupressinum* (N.Z. rimu) ..	☆					☆	☆						☆		
D				☆								☆			☆		*Davidia involucrata* (ghost tree)	☆					☆	☆								
D			☆					☆	☆			☆			☆		*Diospyros kaki* (persimmon)		☆					☆								
E							☆	☆				☆			☆		*Dysoxylum spectabile* (N.Z. kohekohe) ..		☆				☆	☆								☆
E					☆			☆			☆				☆		*Elaeocarpus cyaneus*		☆					☆								☆
E					☆			☆			☆				☆		*E. dentatus* (N.Z. hinau)	☆						☆								☆
D					☆							☆				☆	*Erythrina indica* (coral tree)		☆				☆	☆								
E					☆						☆		☆				*Embothrium coccinum* (fire bush)	☆						☆								☆
E							☆	☆				☆		☆			*Eriobotra japonica* (loquat)		☆			☆		☆								☆
E					☆			☆		☆		☆		☆			*Eucalyptus* ficifolia* (red gum) ..		☆			☆		☆			☆					
E						☆					☆			☆			*E. lehmani*		☆				☆	☆			☆					
E							☆					☆		☆			*E. leucoxylon rosea* (*E. campbelli*) ..		☆			☆	☆	☆			☆	☆	☆			
E	☆				☆				☆	☆		☆		☆			*Eugenia myrtifolia* (Aust. rose apple) ..		☆			☆	☆					☆				☆
D									☆			☆	☆				*Euonymus europaeus* (spindle tree)	☆						☆								☆
E		†										☆	☆				*E. japonicus*†	☆				☆	☆					†		☆	†	†
D	†											☆			☆		*Fagus sylvatica*† (European beech) ..	☆						☆				☆	☆			
D	†		☆									☆		†	☆		*Fraxinus excelsior*† (ash)	☆					☆	☆				☆	☆			
D			☆		☆							☆			☆		*F. ornus* (manna ash)	☆					☆	☆				☆	☆			
DC			☆									☆				☆	*Ginkgo biloba* (maiden hair tree) ..	☆						☆				☆	☆			

Explanations of terms and symbols used in the chart—Fruit: Includes conspicuous pods, etc. **Habit:** This is a rough guide only. Trees classed as spreading are those whose spread is more or less equal to or greater than the height. **Height:** When mature. **Hardiness: Hardy:** Will grow almost anywhere in the country, but in very cold districts further inquiries should be made. **Half-hardy:** Will stand light frosts. **Shelter when young:** Need extra protection from cold and wind until well established. **Soil: Continuously wet:** Swampy or stream side. **Dry:** Soils which dry out badly in summer, but may be wet in winter; for example, clay soils. **Light:** Deep soils which are always well drained. **Uses: Screens and shrub borders:** Small trees suitable for background planting. * After the generic name indicates that there are many other suitable species in addition to those described. † After the specific name indicates that there are varieties, differing from the species. These differences are shown by daggers in the appropriate columns. C: conifer, E: evergreen, D: deciduous.

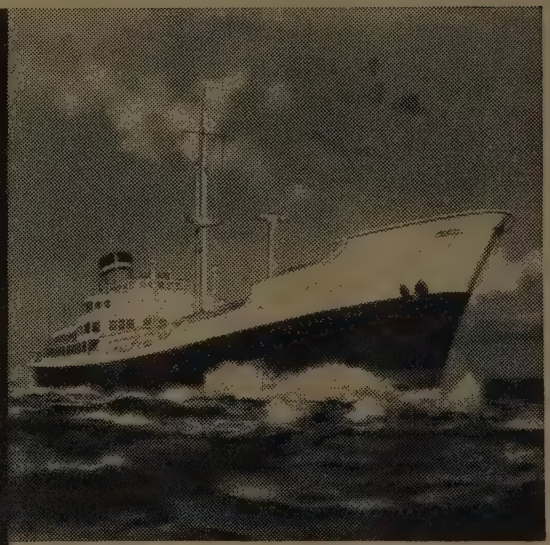
Type	Leaves: Coloured	Leaves: Variegated	Leaves: Autumn colour	Flowers: Spring	Flowers: Summer	Flowers: Autumn	Flowers: Winter	Fruit: Summer	Fruit: Autumn	Fruit: Winter	Habit: Upright	Habit: Spreading	Height: Up to 20ft.	Height: 20ft. to 30ft.	Height: 30ft. to 50ft.	Height: Over 50ft.	Name	Hardiness: Hardy	Hardiness: Half-hardy	Hardiness: Frost tender	Hardiness: Wind resistant	Hardiness: Salt resistant	Hardiness: Shelter when young	Soil: Average	Soil: Continuously wet	Soil: Dry	Soil: Light or sandy	Uses: Specimen	Uses: Shade	Uses: Shelter belts	Uses: Tubs	Uses: Screens, shrub borders
E				☆								☆			☆		*Grevillea robusta* (silky oak)		☆		☆	☆		☆		☆	☆	☆	☆			
E				☆								☆	☆				*Gaya lyalli* (N.Z. whauwhau)	☆						☆				☆				☆
D												☆					*Halesia carolina* (snowdrop tree)	☆						☆								☆
E	†	†										☆	☆				*Hoheria populnea*† (N.Z. houhere)	☆						☆								☆
E			☆			☆						☆					*Howea* (*Kentia*) *fosteriana* (kentia palm) ..			☆				☆				☆				
E									☆	☆		☆					*Idesia polycarpa*	☆						☆				☆			☆	
E		†						☆		☆		☆	†	☆			*Ilex* aquifolium*† (holly)	☆			☆	☆		☆		☆		☆	☆			☆
D					☆									☆			*Jacaranda acutifolia* (jacaranda)			☆			☆	☆				☆				☆
D								☆				☆			☆		*Juglans regia* (walnut)	☆						☆				☆				
C											☆			☆			*Juniperus chinensis* (juniper)	☆						☆		☆		☆			☆	☆
C		†									☆			☆			*J. communis*†	☆						☆				☆			☆	☆
C											☆				☆		*J. virginiana* (pencil cedar)	☆						☆				☆			☆	
E				☆							☆					☆	*Knightia excelsa* (N.Z. rewarewa)		☆		☆	☆		☆				☆				
D			☆						☆			☆	☆				*Koelreuteria paniculata*	☆				☆		☆		☆		☆				☆
D				☆	☆							☆	☆				*Laburnum* vulgare* (golden chain)	☆						☆				☆				☆
E					☆									☆			*Lagunaria patersoni* (Norfolk Is. hibiscus) ..		☆		☆	☆		☆		☆	☆	☆	☆			☆
DC			☆									☆		☆			*Larix decidua* (larch)	☆						☆				☆		☆		
E	☆											☆			☆		*Leucadendron argenteum* (silver tree) ..		☆		☆	☆		☆		☆	☆					☆
C												☆				☆	*Libocedrus decurrens* (incense cedar) ..	☆						☆				☆				
C												☆				☆	*L. plumosa* (N.Z. kawaka)	☆						☆								
D			☆									☆			☆		*Liquidambar styraciflua* (liquidambar) ..	☆						☆				☆				
D		†	☆		☆								☆		†	☆	*Liriodendron tulipifera*† (tulip tree)	☆						☆				☆				
E									☆	☆		☆		☆			*Macadamia ternifolia* (Queensland nut) ..			☆			☆	☆				☆				
E					☆							☆			☆		*Magnolia* grandiflora*	☆						☆				☆				
D				☆								☆		☆			*M. soulangeana* and vars.	☆						☆				☆				☆
D	☆			☆				☆				☆		☆			*Malus* aldenhamensis* (crab apple)	☆						☆				☆				☆
D				☆				☆				☆		☆			*M. angustifolia*	☆						☆				☆				☆
D	☆			☆				☆				☆		☆			*M. eleyi*	☆						☆				☆				☆
D				☆				☆				☆		☆			*M. trilobata*	☆						☆				☆				☆
E				☆					☆			☆			☆		*Melia azedarach* (bead tree)		☆			☆		☆		☆	☆	☆				
DC			☆							☆		☆	☆			☆	*Meryta sinclairi* (N.Z. puka)		☆			☆	☆	☆				☆		☆		
E		†			☆							☆			☆		*Metasequoia glyptostroloides* (dawn redwood)	☆						☆				☆				
E				☆	☆	☆						☆			☆		*Metrosideros* tomentosa*† (N.Z. pohutukawa)		☆		☆	☆	☆	☆		☆		☆				
E												☆			☆		*M. villosa* (Kermadec Is. pohutukawa) ..		☆		☆	☆	☆	☆				☆	☆			
E									☆			☆			☆		*Morus nigra* (mulberry)	☆						☆				☆				
E												☆	☆				*Myoporum laetum* (ngaio)		☆		☆	☆		☆			☆		☆			
E												☆	☆				*M. serratum* (Aust. ngaio)		☆		☆	☆		☆			☆		☆			
E	☆		☆									☆					*Nothofagus* fusca* (N.Z. red beech)	☆						☆				☆				☆
E										☆	☆		☆				*Nothopanax* arboreum* (N.Z. five finger) ..	☆			☆	☆		☆						☆	☆	
D			☆									☆					*Nyssa sylvatica*	☆						☆				☆				
E	☆								☆			☆			☆		*Olea europaea* (olive)		☆		☆	☆		☆	☆		☆	☆	☆	☆		
D				☆								☆	☆				*Olearia** species	☆			☆	☆		☆		☆	☆		☆			☆
D			☆									☆		☆			*Parrotia persica*	☆						☆				☆	☆			☆
D				☆					☆	☆		☆		☆			*Paulownia imperialis*	☆						☆		☆						☆
E				☆							☆		☆				*Phebalium billardieri*	☆			☆	☆		☆			☆		☆			
E				☆								☆		☆			*Phoenix canariensis* (phoenix palm)		☆					☆			☆					
E				☆								☆		☆			*Photinia serrulata*	☆						☆			☆					☆
C											☆			☆			*Phyllocladus glauca* (N.Z. toatoa)	☆						☆				☆				
C											☆				☆		*P. trichomanoides* (N.Z. tanekaha)	☆						☆				☆				
C	†										☆				☆		*Picea* pungens*† (spruce)	☆						☆				☆				
C											☆				☆		*P. morinda*	☆						☆				☆				
C											☆				☆		*Pinus* radiata*	☆				☆	☆				☆					
C												☆			☆		*P. patula*	☆						☆				☆				
C												☆				☆	*P. pinaster*	☆				☆	☆				☆					
E		†		☆					☆	☆		☆					*Pittosporum* crassifolium*† (N.Z. karo) ..	☆				☆	☆				☆				☆	☆
E		†		☆					☆	☆		☆					*P. eugenioides*† (N.Z. tarata)	☆				☆					☆				☆	☆
E	†	†		☆					☆	☆		☆					*P. tenuifolium*†	☆				☆	☆				☆	†			☆	☆
E				☆								☆		☆			*Plagianthus betulinus* (N.Z. manutu) ..	☆						☆				☆				
D												☆				☆	*Platanus* acerifolia* (plane)	☆				☆		☆				☆				
C												☆				☆	*Podocarpus* dacrydioides* (N.Z. kahikatea) ..	☆						☆				☆				
C									☆			☆				☆	*P. ferruginea* (N.Z. miro)	☆						☆				☆				
C	†											☆				☆	*P. totara*† (N.Z. totara)	☆						☆				☆				
D												☆			☆		*Populus* lasiocarpa*	☆						☆				☆				
D			☆									☆				☆	*P. nigra italica* (Lombardy poplar)	☆				☆		☆		☆		☆				
D	☆		☆									☆		☆			*P. serotina aurea* (golden poplar)	☆						☆				☆				
D												☆			☆		*P. yunnanensis*	☆				☆		☆				☆				
D				☆								☆	☆				*Prunus* campanulata*	☆						☆				☆				☆
D	†			☆				☆				☆		☆			*P. cerasifera*† (flowering plum)	☆						☆				☆				☆
E				☆								☆		☆			*P. laurocerasus* (laurel)	☆				☆	☆					☆				
D				☆								☆	☆				*P. mume* (flowering apricot)	☆					☆					☆				☆
D	†			☆								☆		☆			*P. persica*† (flowering peach)	☆					☆					☆				☆
D				☆								☆		☆			*P. pollardi* (flowering almond)	☆						☆				☆				☆
D	†		☆	☆								☆		☆			*P. serrulata*† (flowering cherry)	☆						☆				☆				☆
DC			☆								☆					☆	*Pseudolarix fortunei* (golden larch)	☆						☆					☆			
E											☆			☆			*Pseudopanax crassifolium* (N.Z. lancewood)	☆				☆	☆					☆				☆
E												☆	☆	☆			*P. lessoni* (N.Z. houpara)	☆				☆	☆								☆	☆
C											☆					☆	*Pseudotsuga taxifolium* (Douglas fir) ..	☆						☆					☆			
D			☆					☆			☆			☆			*Pyrus aucuparia* (rowan)	☆					☆					☆				
D			☆					☆				☆	☆				*P. sorbus* (white beam)	☆						☆				☆				
D			☆									☆			☆		*Quercus* cerris* (Turkey oak)	☆					☆					☆				
D			☆									☆			☆		*Q. coccinea* (scarlet oak)	☆						☆				☆				
E												☆			☆		*Q. ilex* (evergreen oak)	☆				☆	☆					☆				
D			☆									☆			☆		*Q. pedunculata* (English oak)	☆						☆				☆				
D			☆									☆			☆		*Q. palustris* (pin oak)	☆						☆				☆				
E			☆									☆	☆	☆			*Rhododendron* spp. and vars.	☆	☆					☆				☆				☆

Partners in Progress

For 75 years, the New Zealand story has been one of continuous enterprise, progress and achievement; and in all that has been done, the ships have been your willing partners and your faithful servants. Indeed, this story of success may well be said to have begun with a ship.

DUNEDIN

The Albion Shipping Company's Clipper "Dunedin" (1,200 tons) sailed from Port Chalmers February 15th 1882, arrived London May 24th, with the first-ever cargo of frozen meat, comprising 4,311 carcases Mutton, 598 carcases Lamb, 22 carcases Pork, 2,226 Sheep Tongues.



WELLINGTON STAR

Today, the Blue Star Line's Motor Vessel "Wellington Star" of 11,994 tons is typical of modern ships in the New Zealand trade. She is ten times as large as the "Dunedin". She carries 21 times as much Mutton and Lamb (108,823 carcases) as well as 7,294 quarters of Chilled Beef, 10,029 packages of frozen Beef, Pork and Sundries, 60,652 cartons of Butter and 60,520 cases of Apples. She can make the voyage Auckland-Dunkirk in 31 days—less than one-third of the time taken by the "Dunedin".

Thus, over the years, have the ships played their part in New Zealand's continuous development. They have more than kept in step with the achievements of producers, for ship-owners must look far ahead. The ship that is built today will still be in service 20 years hence and must be able to handle the trade of the future, as well as that of today. As the Lines join in celebrating the 75th Anniversary of the dispatch of the first shipment of frozen meat, they look forward with confidence to the developments which have yet to come.

Issued in the interests of mutual understanding by

NEW ZEALAND OVERSEAS SHIPPING LINES

SHAW SAVILL & ALBION CO. LTD · THE NEW ZEALAND SHIPPING CO. LTD · PORT LINE LIMITED · BLUE STAR LINE LIMITED

Type	Leaves: Coloured	Leaves: Variegated	Leaves: Autumn colour	Flowers: Spring	Flowers: Summer	Flowers: Autumn	Flowers: Winter	Fruit: Summer	Fruit: Autumn	Fruit: Winter	Habit: Upright	Habit: Spreading	Height: Up to 20ft.	Height: 20ft. to 30ft.	Height: 30ft. to 50ft.	Height: Over 50ft.	Name	Hardiness: Hardy	Hardiness: Half-hardy	Hardiness: Frost tender	Hardiness: Wind resistant	Hardiness: Salt resistant	Hardiness: Shelter when young	Soil: Average	Soil: Continuously wet	Soil: Dry	Soil: Light or sandy	Uses: Specimen	Uses: Shade	Uses: Shelter belts	Uses: Tubs	Uses: Screens, shrub borders
D				☆								☆			☆		*Robinia pseudacacia* (false acacia)	☆		☆				☆		☆	☆	☆	☆	☆		
D												☆			☆		*Salix* babylonica* (weeping willow)	☆						☆	☆			☆				
D											☆			☆			*S. vitellina* (golden willow)	☆						☆				☆				
D											☆			☆			*S. matsudana tortuosa*	☆						☆				☆				
E					☆					☆		☆		☆			*Schinus molle* (pepper tree)	☆			☆		☆	☆			☆	☆	☆			
C											☆					☆	*Sequoia gigantea* (big tree)	☆						☆		☆		☆				
C											☆					☆	*S. sempervirens* (redwood)	☆						☆				☆				
E									☆					☆			*Sideroxylon novae zelandicum* (N.Z. tawapou)		☆		☆	☆		☆				☆				☆
E				☆								☆		☆			*Sophora* tetraptera* (N.Z. kowhai)	☆						☆	☆			☆				☆
E					☆							☆		☆			*S. japonica* (pagoda tree)	☆						☆				☆	☆			
E					☆						☆		☆				*Stenocarpus sinuatus* (firewheel tree) ..					☆	☆	☆		☆		☆				☆
E					☆							☆			☆		*Sterculia (Brachychiton) acerifolia* (flame tree)		☆				☆	☆		☆	☆	☆	☆			
D				☆								☆	☆				*Styrax japonica*	☆						☆				☆				☆
D					☆	☆					☆		☆				*Tamarix gallica* (tamarisk)	☆			☆	☆		☆		☆	☆	☆				☆
DC	☆		☆									☆				☆	*Taxodium distichum* (swamp cypress) ..	☆						☆	☆			☆	☆			
C		†									†	☆			☆		*Taxus* baccata†* (yew)	☆						☆				☆		☆		
C											☆			☆			*Thuja* orientalis* (Chinese arborvitae) ..	☆			☆			☆				☆		☆		
C											☆					☆	*T. plicata*	☆						☆				☆		☆		
C	☆	†									☆				☆		*Thujopsis dolabrata†*	☆						☆				☆				
D			☆		☆							☆			☆		*Tilia europaea* (linden, lime)	☆						☆				☆				
E					☆						☆				☆		*Tristanea conferta*		☆				☆	☆				☆				
D			☆									☆				☆	*Ulmus montana* (elm)	☆			☆			☆				☆				
E				☆	☆							☆		☆			*Virgilia capensis*		☆					☆		☆		☆				☆
E					☆	☆		☆	☆			☆			☆		*Vitex lucens* (N.Z. puriri)		☆			☆		☆				☆				

happy in the warmer parts of the country. Most trees with brilliant autumn foliage are disappointing north of Hamilton.

For coastal districts and areas subject to strong winds, species which will tolerate these conditions have to be chosen. Though a tree may stand salt-laden winds, it will not necessarily grow in sandy soil and vice versa.

With the large range of trees available in New Zealand, it should be possible to select one with the height, shape, foliage, and growth characteristics required for a given position. Young trees in the nursery usually bear little resemblance to their appearance when mature, and a tree should not be chosen just because it looks attractive when young.

Fruit Trees as Ornamentals

On many town sections where space for fruit trees is very limited it is well worth considering many of them as ornamentals. In the warmer parts of the country citrus varieties make excellent ornamentals. Persimmons give brilliant autumn colour and often hold their fruit after the leaves have dropped. Pip and stone fruits and nuts can be used as shade trees and the bold foliage of figs, loquats, and mountain pawpaws can be used where this effect is needed.

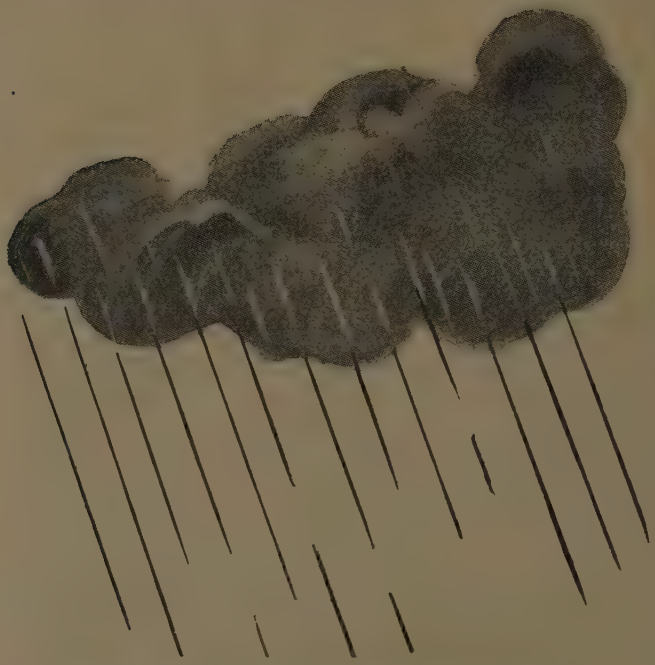
Planting

Most trees may be planted out from late autumn to early spring, provided soil and weather conditions are suitable. If the soil is excessively wet, it is advisable to defer planting until early spring. If the trees have been

[*Elliott*

The copper beech is a handsome tree when allowed to develop to its full size. It is suitable for large gardens, but would be out of place on a small section.

FARMERS . . . WHEN IT'S "FINE WEATHER FOR DUCKS" YOU'LL BE GLAD YOU WEAR



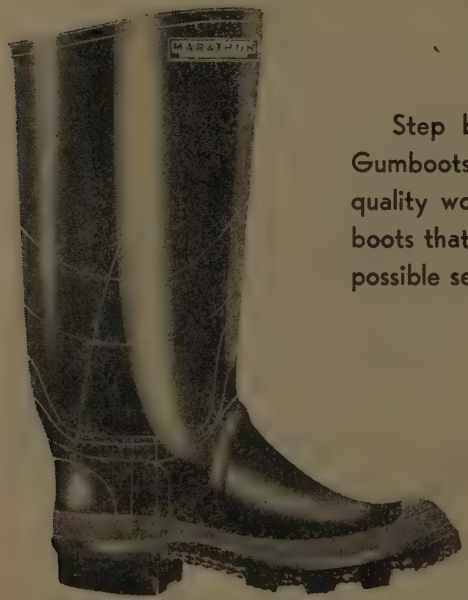
MARATHON GUMBOOTS

Rain, hail or snow, the work of running a farm goes on. The farmer's work is never done and, in wet weather, it behoves the wise farmer to see that his gumboots give him real protection, definite comfort and long reliable service.

All these can be summed up in one word —MARATHON.

"MARATHON" GUMBOOTS

by Skellerup



Step by step of manufacture, the makers of Marathon Gumboots see that only the best materials and the finest quality workmanship go into Marathon Gumboots—the gumboots that are built to exacting standards to give the greatest possible service to every out-door man.

●

MARATHON GUMBOOTS ARE SOLD THROUGHOUT NEW ZEALAND

received from the nursery, they can be heeled in in a sheltered corner until planting conditions improve.

In very cold districts evergreens and conifers should be planted out in mid-autumn so that they can become established before winter, or they can be left until spring, but mid-autumn is preferable. In other districts tender plants are better left until spring. Trees grown in pots or other containers can also be planted out at other times of the year, provided watering is not neglected in dry weather.

Trees respond to good treatment just as does any other garden plant, but only too frequently they are given little care at planting or subsequently. In many ways the initial preparation of the soil for trees is more important than it is for short-lived plants such as herbaceous perennials which are replaced frequently. If a tree is given a good start, it is more likely to remain healthy and vigorous.

The diameter of the hole should be at least three times the spread of the roots or the diameter of the ball of soil. The soil should be broken up to at least two depths of a spade, as this assists drainage and allows easy penetration of the roots. Some well-rotted compost or animal manure should be worked into the soil, especially if it is heavy clay or light and sandy. About 2 handfuls of equal parts of blood and bone and superphosphate or a balanced fertiliser should also be well worked in. If the soil is very heavy, care should be taken that the prepared hole does not act as a drainage sump.

Small plants being set out from pots should have an area of 15in. to 18in. in diameter prepared for them. Some trees, especially Australian species such as acacias and eucalypts, are better planted out from pots when small, as larger plants often do not transplant well.

Deciduous trees usually come from the nursery with bare roots which should be examined before planting and any damaged parts cut off cleanly. They should then be spread out to their full extent. Balled plants should have the sacking removed and the ball of earth slightly loosened. Sometimes when trees are bought late in the season new roots have started to grow through the sacking. In this case the sacking round the ball can be left, but the folds about the stem should be cut away. Pot-grown plants should have the roots loosened if they are twined round the ball of soil.

All trees should be planted out to the same depth as they were growing in the nursery, and the soil should be well firmed round the roots. If staking is necessary, it should be done as the tree is planted. A shelter of scrim is often advisable to protect newly planted trees from frost and wind.

In spring it is as well to make sure that they are firm in the soil and a mulch of compost or sawdust should be applied. During summer watering and weeding should not be neglected and if any pests or diseases are evident, a suitable spray should be applied. During the following spring a complete fertiliser can be worked into the soil and another mulch given.

[*Elliott*

Catalpa bignonioides **(Indian bean) is an attractive deciduous spreading tree.**

Care of Young Trees

Under good garden conditions most trees need little special attention after the second or third year after planting, but they should not be forgotten. Ornamental varieties of fruiting trees such as apples, prunus, and citrus should be sprayed regularly, as they are host plants to many diseases of the orchard.

Some training may be necessary during the first few years to assist the tree to form its correct shape and habit. This usually consists of shortening back any branches which tend to outgrow others and the removal of secondary leaders from trees which normally have a single trunk. Ornamental plums, apples, etc., should be pruned in a similar way to fruiting varieties for the first year or so until the framework is built up. Later, only the pruning necessary to keep the tree in shape is required. This is usually done after flowering.

Trees for shade are usually grown up on a clean trunk at least 6ft. high. Young trees should be taken up on a single leader, but the side branches should not be removed until there is a fair development of branches above this level. By allowing them to remain, a good, strong trunk will develop in a much shorter time. When removed they should be cut off cleanly without stubs.

Maintenance of Older Trees

Old trees sometimes show symptoms of ill health and fail to make satisfactory growth. If this occurs before the tree has reached its normal span, it is probably due to poor soil conditions, lack of water during dry periods, or an insufficiency of plant foods in the soil.

It is not unusual for trees to die because the roots have got down below the permanent water-table and in such cases little can be done. They also often fail because the roots are unable to penetrate a hard pan. In this case they can be assisted by watering and fertilising. At times lack of vigour

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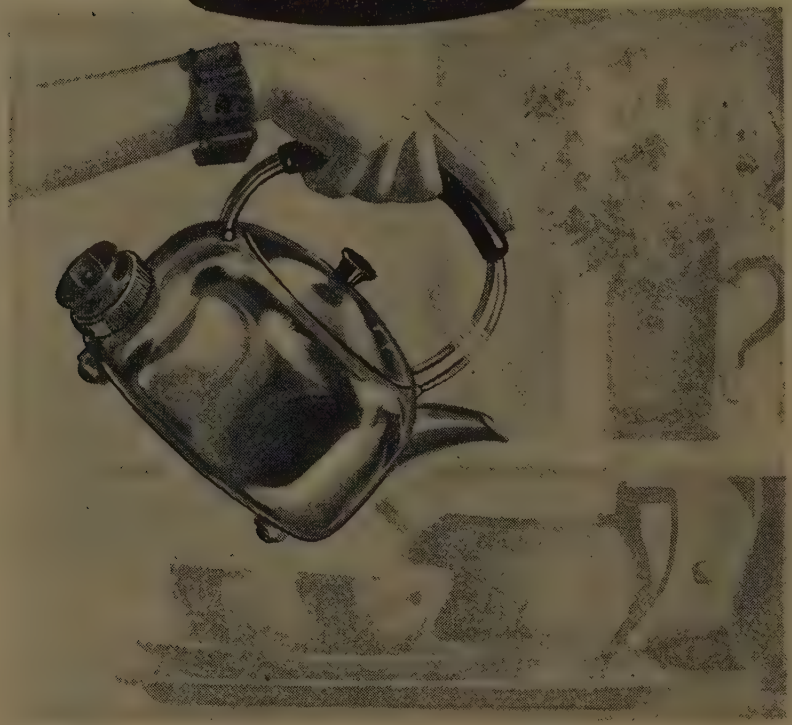

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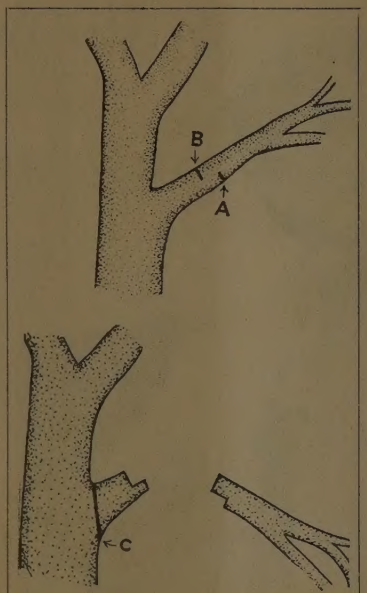

Stages in the removal of a large branch. A—First cut. B—Second cut. C—Third cut.

may be attributed to the depletion of nutrients, usually nitrogen, in the soil. Where the tree is growing in a cultivated area such as a shrub or flower border a good dressing of farmyard manure or blood and bone each year will usually be sufficient.

Specimen trees growing in a lawn are not quite so easy to treat. The best method is to make holes about 12in. to 18in. deep with a crowbar in a band around the tree roughly under the tips of the branches. The number of holes will vary according to the size of the tree, but as a rough guide 1lb. of fertiliser should be allowed to each inch of the trunk diameter, with 4oz. to 8oz. in each hole. A suitable mixture is equal parts of sulphate of ammonia and superphosphate.

Old trees often have dead branches in them. These should be removed or they may rot back into the main branches or trunk.

Where unsuitable trees have been planted and have become too large for the position it is often possible to reduce the size and yet maintain their shape by careful pruning. Though this is more difficult than simply lopping off branches indiscriminately, it is well worth the trouble.

If a large branch must be removed, it should be done correctly so that the cut is clean and there is no torn bark (see diagram on this page). All wounds should be trimmed with a sharp knife and covered with a protective material such as a bituminous paint.

Garden Work in May

May heralds a distinct change of seasons in flower gardens, as both perennials and annual bedding plants have finished flowering and there is little or no colour to be seen. In addition deciduous trees that have been providing a brilliant show have lost nearly all their leaves by the end of May. In southern districts frosts will be quite severe toward the end of May, which means cessation of most work in the garden.

Where frosts are experienced tender plants should be adequately protected either by placing scrim on a frame over them or by using macrocarpa branches or bracken fronds in the form of a tripod. Where the scrim is used it may have to be lifted to allow air and sunlight to get to the plants during the day, but with the other materials sufficient light will penetrate the cover.

Gladiolus

Gladiolus corms that have been lifted and dried off should be ready for cleaning during May. Though this process is not entirely necessary, it provides an opportunity to inspect the corms and discard diseased ones before the infection spreads to others. Any that are showing signs of disease should be burnt and the remaining healthy corms should be dusted with 5 per cent. DDT dust before being stored. This will control thrips which, if left on the corms, will overwinter in the scales and build up large populations by the time planting is due. Rotting in store can be reduced by mixing 1 part of thiram to 5 parts of the DDT dust.

Cuttings

Though it is late in the season to take half-ripened cuttings, hard-wood cuttings can be taken from woody plants in May. Tender and half-hardy plants may be propagated from cuttings taken at this time of the year in areas where frosts would kill plants left in the garden. Fibrous-rooted begonias are an example of the type of material which can be perpetuated by this means. Young shoots that have grown vigorously should be taken as cuttings and the lower leaves removed. The cuttings should then be placed in soil that has had plenty of clean river sand added to it, preferably in a frame that will give protection from frost.

Pot Plants

At this time of the year pot plants are coming into their own as plants for using indoors. Cyclamen, *Primula obconica*, ferns, and perhaps very early bulbs are all used inside to give the colour that is lacking in the garden. Cyclamen and primulas are nearly always flowering when they are bought, but very often no more flowers are produced and the purchaser is very disappointed.

Though these plants will do well without very much attention, there are certain conditions which they do not tolerate. They should be placed in a position where they get as much light as possible, not in a dark corner. Pot plants should never be put near a fire, as the high temperature causes them to wilt. On the other hand, they should not be placed in a draughty position, as that, too, checks the production of flowers and may eventually kill the plant.

Watering should be done frequently enough to keep the soil in the pots moist. The water should be applied to the top of the pot and allowed to drain through, rather than standing the pot in a saucer of water, when the lower portion of the soil becomes saturated and the top may be very dry. When cyclamen are being watered care should be taken not to wet the corms, as frequent applications may cause the corms to rot.

Chrysanthemums

One of the pests that attack chrysanthemums every season is eelworm, and there is little that can be done to eradicate this pest unless the grower is prepared to spend a great deal of time on this task. Planting in a different patch of the garden every year will help, provided the same area is not used for chrysanthemums again for 4 to 5 years. During May or when the flowers are finished any infected plants, which are those which lost their lower leaves early in the season, should have the flowering stalks cut off and these together with any dead leaves on the ground should be collected and burnt. When the new shoots start into growth they should be sprayed twice at about 14-day intervals, and once again when the stools have been split and planted out into fresh soil with nicotine sulphate 1 teaspoonful to 1 gallon of water. This does not kill the eelworms, but deters them from entering the roots of the young plants.

Lime

A dressing of lime may be spread in early winter on those parts of the garden that need it. One to 2oz. to the square yard are sufficient for most plants, but heavier applications may be necessary where large amounts of organic manure are dug in regularly. Shrubs such as daphne, rhododendron, azalea, and boronia do not thrive in a soil where there is any quantity of free lime, so it should never be applied near these plants.

Delphiniums, sweet peas, and Iceland poppies are all lime lovers and do best in a soil that is slightly alkaline. A neutral or slightly acid soil is best for most plants. The flower garden should not be limed indiscriminately for the reasons already given.

An Elegant White Jacket

THE white knitted jacket illustrated would surely be considered attractive by most women. Though very suitable for casual wear, it is undoubtedly elegant, and makes an attractive accessory for other attire in black.

ABBREVIATIONS: K., knit; p., purl; st., stitch; sts., stitches; st. st., stocking stitch; g. st., garter stitch; inc., increase; dec., decrease; cont., continue; beg., beginning; fin., finishing; sl., slip; p.s.s.o., pass slipped stitch over; m., make; foll., following; tog., together; rep., repeat; rem., remaining.

Materials: 15oz. of double knitting wool; 2 No. 9, 2 No. 10, and 2 No. 11 knitting needles.

Measurements (to fit a 36in. bust): Length 18in.

Tension: 6½ sts. to 1in.

The Pockets

Using No. 9 needles cast on 30 sts. and work in st. st. for 3½in., fin. after a knit row. Leave sts. on spare needle.

The Right Front

Using No. 9 needles cast on 56 sts. and work in st. st. for 3½in., fin. after a p. row.

Next row: K. 13, cast off next 30 sts., k. to end.

Next row: P. 13, p. across 30 sts. of one pocket lining, p. to end.

Cont. straight until work measures 9½in., fin. after a k. row.

Shape for Sleeve and Front

Inc. 1 st. at beg. of next row and at this edge on every row until there are 67 sts.

Next row (front edge): K. 2 tog., k. to end.

Now cast on 4 sts. at beg. of next 8 alternate rows, then cast on 28 sts. at beg. of foll. alternate row, then cont. straight at sleeve edge but at the same time dec. 1 st. at front edge on every 4th row until 10 sts. have been taken off at front edge (117 sts. rem.). Cont. straight until straight edge of sleeve measures 5in., fin. after a p. row. Leave for the present.

The Left Front

Work to match the right front, but reading k. for p. and p. for k. until sleeve edge measures 5in. on the straight, fin. after a p. row.

Next row: K. 117 sts., cast on 26 sts., k. 117 sts. from right front sts.

The Back

Cont. straight on these sts. until sleeve at straight edge measures 10in. Now cast off 28 sts. at beg. of next 2 rows, 4 sts. at beg. of next 16 rows, and dec. 1 st. at each end of next 11 rows.

Cont. straight on rem. 118 sts. for 5½in., then change to No. 11 needles and dec. 1 st. at each end of next row and every foll. 3rd row until 96 sts. remain. Cont. straight until back measures 9½in. from sleeve shaping. Cast off.

The Border

Using No. 10 needles cast on 10 sts. and work thus:—

1st row: K. 7, m. 1, sl. 1, k. 1, p.s.s.o., k. 1.

2nd row: K.

Rep. these 2 rows 3 times more.

9th row: (sl. 1, k. 2 tog., p.s.s.o.) twice, k. 1, m. 1, sl. 1, k. 1, p.s.s.o., k. 1.

10th row: K.

11th row: (K. in front, back and front of next st.) twice, k. 1, m. 1, sl. 1, k. 1, p.s.s.o., k. 1.

12th row: K.

These 12 rows form the patt. Rep. them until border slightly stretched measures length of lower edge of back and along right front to corner, fin. after a 4th patt. row.

Mitre corner thus:—

Next 2 rows: K. 7, turn and k. back.

Next 2 rows: K. 6, turn and k. back.

Cont. in this way, working 1 st. less on alternate rows until 1 st. remains.

Next 2 rows: K. 2, turn and k. back.

Next 2 rows: K. 3, turn and k. back.

Cont. in this way until the row "K. 7, turn and k. back".

Next row: As 7th patt. row.

Next row: As 8th patt. row *.

Cont. in patt. until border is long enough to go up right front, round neck, and down to the corner of left front, then mitre corner as from * to *.

Cont. in patt. for sufficient length of lower edge of left front. Cast off.

The Pocket Borders

Using No. 10 needles cast on 10 sts. and work in patt. for 4½in. Cast off.

The Sleeve Borders

Work as for pocket border, but for 10in. Cast off.

To Make up

Press work on the wrong side with a hot iron over a damp cloth. Sew up under-arms and sleeve seams. Sew pocket linings into position, then sew on all borders. Press seams.

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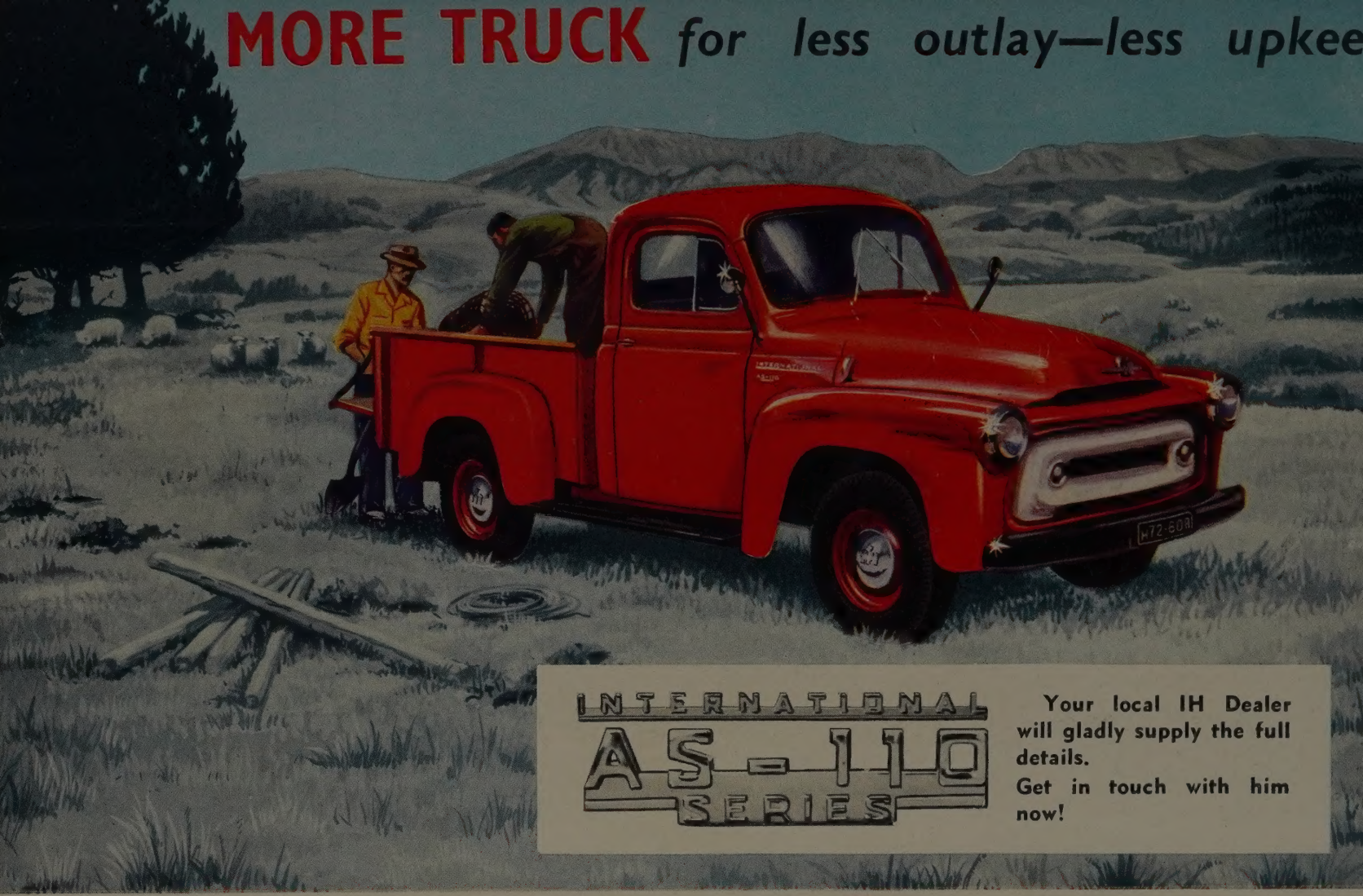

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